SERVICE MANUAL
OSCILLOSCOPE
COS5040
MODEL COS5041

Kikusui
INTERNATIONAL CORP.

TABLE OF CONTENTS

		PAGE
1.	GENERAL	1
	1.1 Description	1
	1.2 Features	1
2.	SPECIFICATIONS	3
3.	CIRCUIT DESCRIPTION	10
	3.1 General	10
	3.2 Preamplifiers	13
	3.3 Vertical Switching Circuit	16
	3.4 Delay Line Circuit	20
	3.5 Vertical Output Amplifier	20
	3.6 Trigger Generator	21
	3.7 A and B Sweep Generators	23
	3.8 Horizontal Switching Circuit	27
	3.9 Horizontal Output Amplifier	28
	3.10 Z-axis Amplifier	29
	3.11 CRT Control Circuit	29
	3.12 H.V Regulator (High Voltage Gerenator)	30
	3.13 Power Supply Circuit	30
	3.14 Calibrator Circuit	31
4.	CALIBRATION	32
	4.1 General	32
	4.2 Removing the Case	32
	4.3 Check and Adjustment of DC Supply Voltages	33
	4.4 Adjustment of CRT Circuits	34
	4.5 Adjustment of Vertical Axis	35
	4.6 Adjustment of Trigger Circuit	40
	4.7 Adjustment of Time Base	41
	4.8 Adjustment of Horizoutal Axis (X-axis)	43

* BLOCK DIAGRAM

* CIRCUIT SCHEMATICS

MODELS COS5040 AND COS5041

VERTICAL AMPLIFIER ..... ◇1

TRIG & SWEEP GENERATOR ..... ◇2

CRT CIRCUIT & POWER SUPPLY ..... ◇3

* PARTS LOCATIONS

Vert Amp & Power Supply A1 ..... [1]

Sweep & H.V A2 ..... [2]

* SEMICONDUCTOR LEAD CONFIGURATION

* REPLACEABLE PARTS

FOR MODEL COS5040 ..... 1/13 ~ 13/13

FOR MODEL COS5041 ..... 1/14 ~ 14/14

* MECHANICAL ASSEMBLY DRAWINGS

FRONT PANEL ASSEMBLY (COS5021/COS5041) 316097

FRONT PANEL ASSEMBLY (COS5020/COS5040) 316098

FRONT FRAME ASSEMBLY 316099

REAR PLATE ASSEMBLY 316100

CRT ASSEMBLY 316101

CIRCUIT BOARD ASSEMBLY (VERTICAL) 316104

CIRCUIT BOARD ASSEMBLY (TIME-BASE) 316106

CIRCUIT BOARDS INSTALLATION 316107

COVER & HANDLE ASSEMBLY 316109

BOTTOM PLATE ASSEMBLY 316110

1. GENERAL

1.1 Description

Kikusui Model COS5040/5041 Oscilloscope is a dual-channel oscilloscope with frequency bandwidth DC - 40 MHz (-3 dB), maximum sensitivity 1 mV/DIV, and maximum sweep time 20 nsec/DIV. Model 5041 has a sweep magnification feature with B sweep. The oscilloscope employs a 6-inch rectangular type cathode-ray tube with red internal graticule.

The oscilloscope is sturdy, easy to operate, and exhibits a high operation reliability. It is incorporated with the various convenient features and excellent functions, making itself an ideal instrument for diversified types of research and development work of electronic devices and equipment it can also be efficiently used for production lines and for maintenance and service.

1.2 Features

(1) Compact, light, but sturdy:

The oscilloscope is made of aluminium diecast and it is compact, light, but sturdy.

(2) Excellent operability:

Light torque types of lever switches and pushbutton switches are used. These and other controls are laid out in the most rational locations taking purposes and frequencies of their uses into consideration, thereby attaining an excellent operability.

(3) High-brightness Domed-mesh type CRT, high post scceleration voltage. (12 kV):

The high acceleration voltage and high beam-efficiency of CRT ensures a bright trace for high speed sweep observation.

(4) High stability with less drift:

The oscilloscope employs a newly-developed temperature compensation circuit, thereby greatly reducing drift of base lines and DC balance distrubance caused by temperature change.

(5) A trigger level lock function which makes triggering adjustment procedure unnecessary:

A new trigger level lock circuit is incorporated. This circuit eliminates the requirement of troublesome triggering adjustment procedure not only for display of regular signals but also for that of video signals and large duty cycle ratio signals.

(6) TV sync triggering:

The oscilloscope has a sync separator circuit and triggering for TV V signal and TV H signal can be automatically switched being linked to the TIME/DIV switch.

(7) Linear focus:

Once the beam focus is adjusted to the optimum position, it is automatically maintained irrespective of intensity change, even for such waveforms with brightness variation as those displayed in the A INTEN mode.

2. SPECIFICATIONS

Vertical axes

Item	Specification	Remarks
Sensitivity	NORM: 5 mV - 5 V/DIV ×5 MAG: 1 mV - 1 V/DIV	1-2-5 sequence, 10 ranges
Sensitivity accuracy	NORM: ±3% or better ×5 MAG: ±5% or better	10 to 35°C (50 to 95°F), 1 kHz, at 4 or 5 DIV
Vernier vertical sensitivity	To 1/2.5 or less of panel-indicated value	
Frequency bandwidth	NORM: DC - 40 MHz, within -3 dB ×5 MAG: DC - 20 MHz, within -3 dB AC coupling: Low limit frequency 10 Hz	With reference to 50 kHz, 8 DIV
Rise time	NORM: Approx. 8.75 nsec ×5 MAG: Approx. 17.5 nsec	
Input impedance	1 MΩ ±2%, 25 pF ±2 pF	
Square wave characteristics	Overshoot: Not greater than 5% Other distortions: Not greater than 3% (At 10 mV/DIV range)	Other ranges: 3% added to the left values. 10 to 35°C (50 to 95°F)
DC balance shift	NORM: ±0.5 DIV ×5 MAG: ±2.0 DIV	
Linearity	±0.1 DIV or less of amplitude change when waveform of 2 DIV at graticule center is moved vertically.	
Display modes	CH1: CH1 single channel CH2: CH2 single channel DUAL: CHOP: 0.5 sec - 1 msec/DIV ALT: 0.5 msec - 0.2 µsec/DIV	When CH1 POSITION knob is pulled out (CHOP ONLY position), the two traces are displayed in the CHOP mode at all ranges.

Item	Specification		Remarks
	ADD:	CH1 + CH2 algebraic addition	
Chopping repetition frequency	Approx. 250 kHz		
Input coupling	AC/GND/DC		
Maximum allowable input voltage	400 V (DC + AC peak)		AC: 1 kHz or lower
Common mode rejection ratio	50:1 or better at 50 kHz, sinusoidal wave		When sensitivities of CH1 and CH2 are set equal
Isolation between channels	At least 1000:1 at 50 kHz At least 30:1 at 40 MHz		At 5 mV/DIV range
CH1 signal output	Approx. 100 mV/DIV when open; approx. 50 mV/DIV when 50-ohm termination		
CH2 INV BAL	Balanced point variation, 1 DIV or less		PULL CH2 POSITION (Reference at center graticule)
Signal delay time	Approx. 40 nsec (with delay cable of approx. 120 nsec)		The displayed portion preceding the triggering point

Triggering

Item	Specification	Remarks
Triggering source	CH1, CH2, LINE, and EXT (CH1 and CH2 can be selected only when the vertical mode is DUAL or ADD. In other cases, triggering source is automatically selected by the VERT MODE switch.)	
Coupling	AC, HF REJ, TV, DC	
Polarity	+ or -	

Item	Specification	Remarks
Sensitivity	DC - 10 MHz: 0.5 DIV (0.1 V) DC - 40 MHz: 1.5 DIV (0.2 V) Video signal: 2.0 DIV (0.2 V) AC coupling: Attenuate signal components of lower than 10 Hz HF REJ: Attenuate signal components of higher than 50 kHz	The values enclosed in the parentheses are the input sensitivities when in the EXT triggering mode.
Triggering modes	AUTO: Sweeps run in the free mode when no triggering input signal is applied.	Satisfies the sensitivity specification for signal repetition frequency of 50 Hz or over.
	NORM: When no triggering signal is applied, the trace is in the READY state and not displayed. SINGL: One-shot sweep with triggering signal. Can be reset to the READY state by means of RESET switch. The READY lamp (LED) turns on when in the READY state or in the sweep operation.	
LEVEL LOCK	Satisfies the value of the above trigger sensitivity plus 0.5 DIV (0.05 V) for signal of duty cycle 20:80 and repetition frequency 50 Hz - 40 MHz.	
EXT triggering signal input	EXT HOR input terminal is used in common.	
Input impedance	1 MΩ ±2%, approx. 25 pF	
Maximum allowable input voltage	100 V (DC + AC peak)	AC frequency not highter than 1 kHz
B triggering signal	The A triggering signal of main sweep is used as the B triggering signal.	Model COS5041 only

Horizontal axis

Item	Specification	Remarks
Horizontal axis display	A, A INT, B, B TRIG'D	COS5041 only
A sweep (main sweep)		
Sweep time	0.2 µsec - 0.5 sec/DIV	1-2-5 sequence, 20 ranges
Sweep time accuracy	±3%	10 to 35°C (50 to 95°F)
Vernier sweep time control	To 1/2.5 or slower of panel-indicated value	
Holdoff time	Continuously variable to 2 times or over of sweep length (time) at 0.2 µsec/DIV - 1 msec/DIV ranges	
B sweep		COS5041 only. Triggered by A triggering signal
Delay system	Continuous delay and triggered delay	
Sweep time	NORM: 0.2 µsec/DIV - 0.5 msec/DIV ×10 MAG: 20 nsec/DIV - 50 µsec/DIV	
Sweep time accuracy	NORM: ±3%	10 to 30°C (50 to 95°F)
Delay time	2 µsec - 5 msec/DIV	
Delay time accuracy	±4% of the value read on CRT	
Delay jitter	1/10,000 or less $\frac{\text{B sweep time}}{\text{A sweep time}} \times \frac{\text{jitter width}}{\text{10 DIV}}$	Jitter width 0.5 DIV or less at A: 1 msec/DIV B: 1 µsec/DIV
Sweep magnification	10 times (maximum sweep time 20 nsec/DIV)	
Magnified sweep time accuracy	0.1 µsec/DIV - 0.5 sec/DIV ranges: ±5% 0.2 µsec/DIV - 0.5 µsec/DIV ranges: ±8%	10 to 35°C (50 to 95°F)
Linearity	NORM: ±3% ×10 MAG: ±5% (±8% for 0.2 µsec and 0.5 µsec/DIV	

Item	Specification	Remarks
Position shift caused by sweep magnification	Within 1 DIV at CRT screen center	
X-Y mode	X-axis: CH1 input signal Y-axis: CH2 input signal	
Sensitivity	Same as CH1 vertical axis	
Sensitivity accuracy	NORM: ±4% ×5 MAG: ±6%	10 to 35°C (50 to 95°F), 1 kHz, at 4 or 5 DIV
Frequency bandwidth	DC - 2 MHz (-3 dB)	
X-Y phase difference	Not greater than 3° at DC - 100 kHz	
EXT HOR mode	Trace swept by an external horizontal signal applied to the EXT TRIG IN terminal. Vertical axis modes are CH1, CH2, DUAL and ADD modes in the CHOP mode.	
Sensitivity	Approx. 0.1 V/DIV	
Frequency bandwidth	DC - 2 MHz (-3 dB)	
Phase difference between vertical axis	Within 3° (at DC - 100 kHz)	

Z axis

Item	Specification	Remarks
Sensitivity	3 Vp-p (Trace becomes brighter with negative input.)	
Frequency bandwidth	DC - 5 MHz	
Input resistance	Approx. 5 kΩ	
Allowable input voltage	50 Vp-p (DC + AC peak)	AC frequency not higher than 1 kHz

Calibration voltage

Item	Specification	Remarks
Waveform	Positive-going square wave	
Frequency	1 kHz ±20%	
Duty ratio	Within 45:55	
Output voltage	2 Vp-p, ±2%	
Output resistance	Approx. 2 kΩ	

CRT

Item	Specification	Remarks
Type	6-inch rectangular type, internal graticule	
Phosphor	P31	
Acceleration voltage	Approx. 12 kV	
Effective screen size	8 × 10 DIV	1 DIV = 10 mm (0.39 in.)
Graticule	Internal graticule; continuously adjustable illumination	

Line power requirements

Voltage: 100 V, 115 V, 215 V, 230 V; with ±10% allowance.
Selectable by connector change

Frequency: 50 Hz or 60 Hz

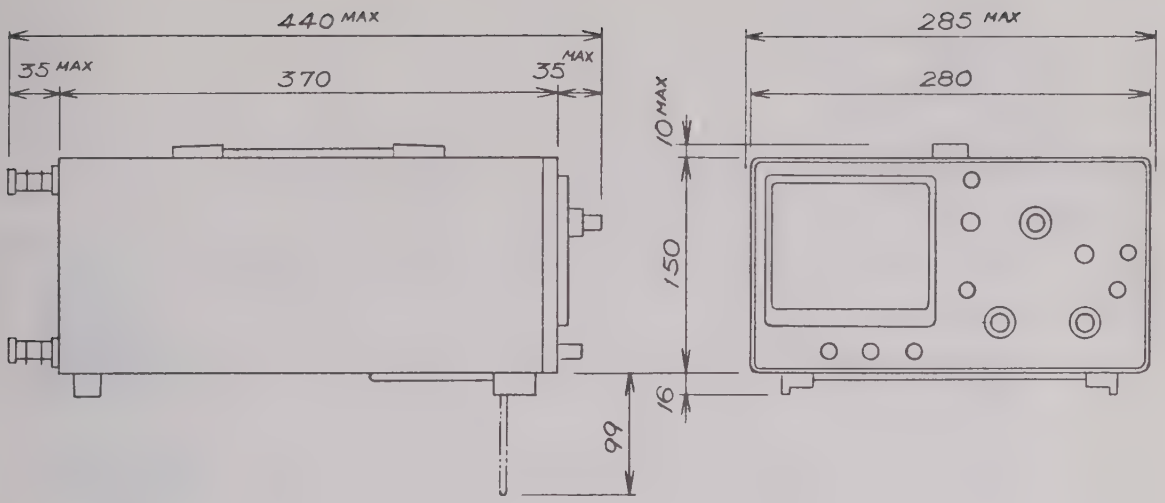
Power consumption: Approx. 35 VA

Mechanical specifications

Mainframe dimensions: 280 W × 150 H × 370 D mm
(11.02 W × 5.91 H × 14.57 D in.)

Maximum dimensions: 285 W × 175 H × 440 D mm
(11.22 W × 6.89 H × 17.32 D in.)

Weight: Approx. 7.1 kg (16 lbs)



Operating environment

To satisfy specifications: 5 to 35°C (41 to 95°F), 85% RH

Maximum operating ranges: 0 to 40°C (32 to 104°F), 90% RH

Accessories

960 BNC probes (10:1, 1:1, 1.5 m) ..	(89-03-0220)	2
942A terminal adaptors	(W4-986-011)	2
Power cord		1
Instruction manual		1

o Specifications and contents on this manual are subject to change without notice.

3. CIRCUIT DESCRIPTION

3.1 General

The overall circuit structure of the oscilloscope is as depicted with a block diagram in Figure 3-1. It is comprised of a vertical deflection circuit for moving the beam spot in the Y-axis direction on the CRT screen, a horizontal deflection circuit for operating the cathode-ray tube, a calibrator circuit for calibrating the instrument probe, and a power supply circuit for supplying powers to the various circuits of the instrument.

The vertical amplifier circuit has two mutually independent preamplifiers (CH1 and CH2), a vertical switching circuit, a delay line, and a vertical output amplifier.

Each of the preamplifiers amplifies or attenuates its input signal of several millivolts to several hundreds volts into a level suitable for handling by the subsequent stage. The conditioned vertical signals are sent to the vertical switching circuit. The trigger signals also are picked off at this stage.

The vertical switching circuit electronically switches the vertical signals received from the CH1 and CH2 preamplifiers. The switched signal is fed via the delay line circuit to the vertical output amplifier. The trigger signals also are switched and fed as internal trigger signals to the trigger generator.

The vertical output amplifier amplifies the vertical signal, which is received through the delay line circuit, into a level of several volts to several tens volts for vertically deflecting the beam spot on the CRT screen.

The horizontal deflection circuit has a trigger generator, sweep generators, a horizontal switching circuit, and a horizontal output amplifier.

The trigger generator receives the internal trigger signal from the vertical switching circuit or an external trigger signal from the EXT TRIG INPUT terminal and generates a trigger pulse signal.

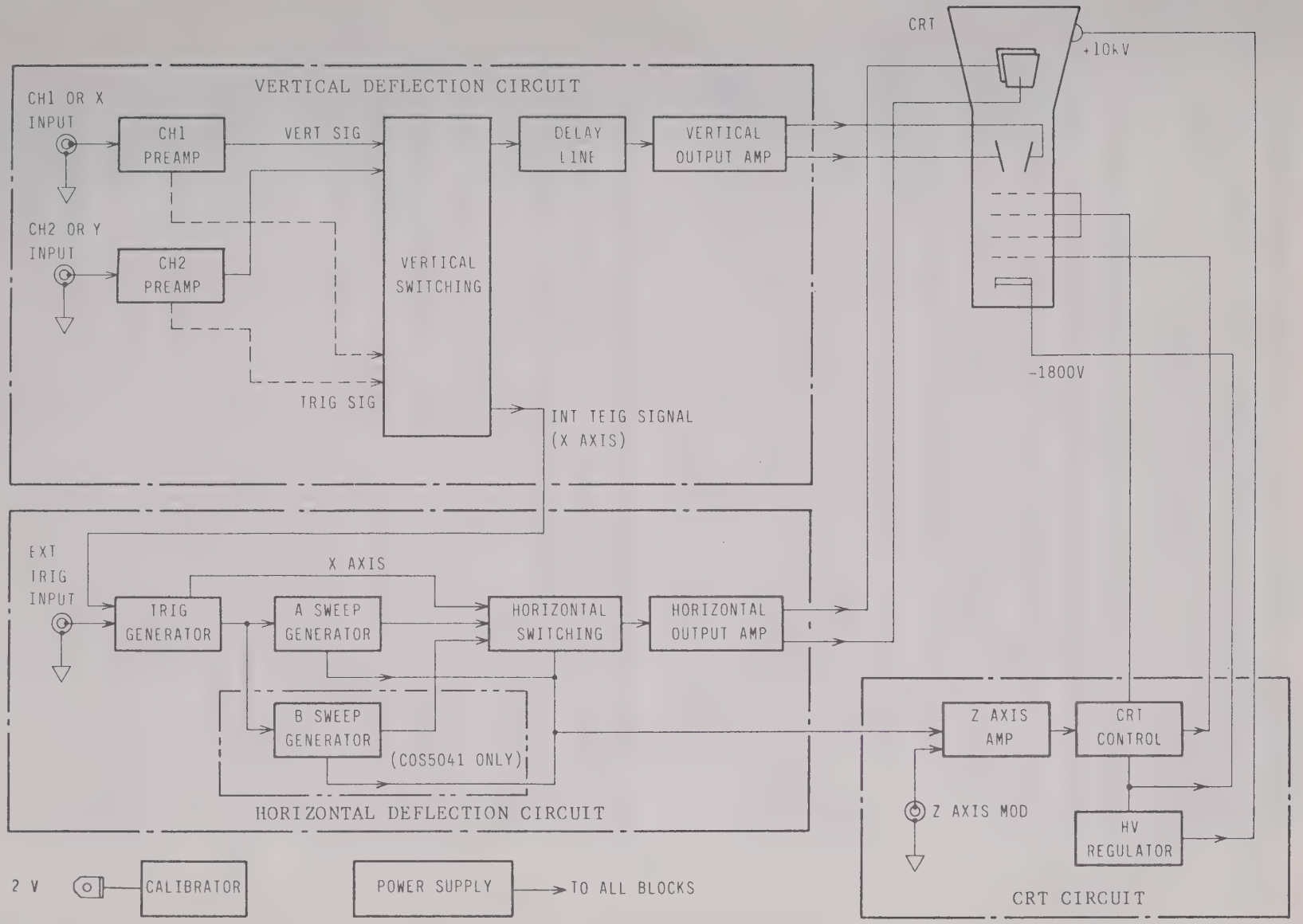

VERTICAL DEFLECTION CIRCUIT
CH1 OR X INPUT
CH1 PREAMP
VERT SIG
DELAY LINE
VERTICAL OUTPUT AMP
CH2 OR Y INPUT
CH2 PREAMP
VERTICAL SWITCHING
TRIG SIG
INT TEIG SIGNAL (X AXIS)
CRT
+10kV
-1800V
EXT TRIG INPUT
X AXIS
TRIG GENERATOR
A SWEEP GENERATOR
HORIZONTAL SWITCHING
HORIZONTAL OUTPUT AMP
B SWEEP GENERATOR
(COS5041 ONLY)
HORIZONTAL DEFLECTION CIRCUIT
Z AXIS AMP
CRT CONTROL
Z AXIS MOD
HV REGULATOR
CRT CIRCUIT
2 V
CALIBRATOR
POWER SUPPLY
TO ALL BLOCKS

Figure 3-1

The A sweep generator is driven by the trigger pulse signal of the trigger generator and produces the A sawtooth signal. The sweep generator produces a sawtooth signal even when no trigger pulse is applied to it (the AUTO mode).

The B sweep generator produces the B sawtooth signal, being driven by the delayed sweep start signal produced with respect to the A sawtooth signal when in the continuous delay mode (HOR DISPLAY: B). When in the synchronized delay mode (HOR DISPLAY: B TRIG'D), the B sweep generator generates the B sawtooth signal being driven by the trigger pulse signal of trigger generator which follows the above delayed sweep start signal. (COS5041 ONLY)

The horizontal switching circuit electronically switches the sawtooth signals received from the A and B sweep generators and the CH1 HOR signal received from the vertical switching circuit when in the X-Y mode of operation, and sends the resultant signal to the horizontal output amplifier.

The horizontal output amplifier amplifies the output signal of the horizontal switching circuit to a level of several volts to several tens volts in order to drive horizontally the beam spot on the CRT screen.

The CRT circuit is comprised of a high voltage generator (the HV regulator) to accelerate the electron beam emitted from the CRT cathode, a Z-axis amplifier to amplify the signal to blank out the return traces, and a CRT control circuit to operate the CRT tube in its optimal state.

The HV regulator provides a -1.8 kV voltage which is applied to the CRT cathode to accelerate the electrons emitted by it and a 10 kV voltage which is used as a post-acceleration voltage to accelerate further the electrons after passing the vertical and horizontal deflection plates.

The Z-axis amplifier amplifies the unblanking signals received from the A and B sweep generators and the trace intensity control signal to a level of several tens volts in order to be applied to the 1st grid (control grid) of the CRT via the CRT circuit.

The CRT circuit provides the various voltages for the CRT electrodes so that the CRT operates in an optimal state, displaying sharply-focussed less-distorted signal waveforms. It also conditions the signals received from the Z-axis amplifier and other circuits into levels suitable for application to the CRT.

3.2 Preamplifiers

The CH1 preamplifier amplifies the signal of the CH1 or X input terminal. The CH2 preamplifier amplifies the signal applied to the CH3 or Y input terminal. A detailed block diagram is shown in Figure 3-2.

- Input coupling switch:

The input coupling switch (S102/S202) selects the input coupling mode for AC, GND, or DC. When the GND state is selected, the preamplifier input is isolated from the input terminal and is grounded so that the base line (0 level) on the CRT screen can be checked.

- Attenuators:

Each of the CH1 and CH2 attenuator circuits consists of two attenuators: The 1st attenuator for 1/1, 1/10 and 1/100, and the 2nd attenuator for 1/1, 1/2, 1/4 and 1/10. By switching these attenuators with the VOLTS/DIV switch (S101/S201), the signal can be attenuated for a total range of 1/1 to 1/1000 in 10 steps.

The 1st attenuator directly attenuates the signal received from the input coupling switch and feeds the attenuated signal to the voltage follower. The 2nd attenuator attenuates the low-impedance output signal of the voltage follower and feeds the attenuated signal to the 1st differential cascade amplifier.

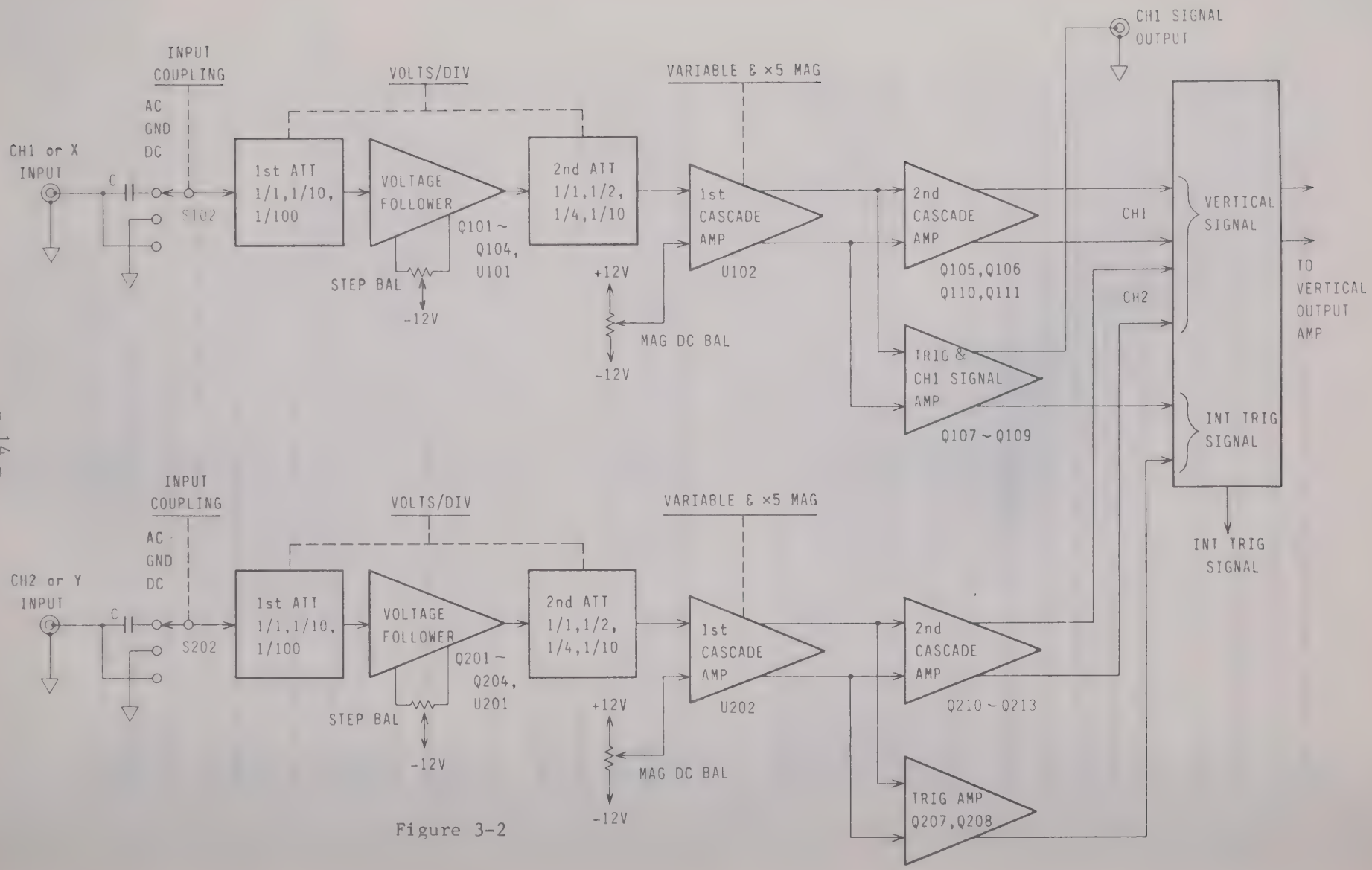

CH1 SIGNAL OUTPUT
INPUT COUPLING
AC
GND
DC
VOLTS/DIV
VARIABLE & ×5 MAG
CH1 or X INPUT
C
S102
1st ATT 1/1,1/10, 1/100
VOLTAGE FOLLOWER
Q101~ Q104, U101
2nd ATT 1/1,1/2, 1/4,1/10
1st CASCADE AMP
U102
2nd CASCADE AMP
Q105,Q106 Q110,Q111
CH1
VERTICAL SIGNAL
TO VERTICAL OUTPUT AMP
CH2
STEP BAL
-12V
+12V
MAG DC BAL
TRIG & CH1 SIGNAL AMP
Q107~Q109
INT TRIG SIGNAL
INT TRIG SIGNAL
CH2 or Y INPUT
S202
1st ATT 1/1,1/10, 1/100
VOLTAGE FOLLOWER
Q201~ Q204, U201
2nd ATT 1/1,1/2, 1/4,1/10
1st CASCADE AMP
U202
2nd CASCADE AMP
Q210~Q213
TRIG AMP Q207,Q208

Figure 3-2

o Impedance converter:

The impedance converter provides with its source follower (Q101/Q201) a high input impedance to prevent the loading effect on the high-impedance attenuator circuit and provides a low output impedance with its emitter follower (CH1 and CH2) to drive the 1st differential cascade amplifier of the next stage. In order to guard against thermal drift, the source follower employs a dual-FET package which houses two thermally-coupled elements for thermal drift compensation and the emitter follower employs two premium-grade thermally-coupled transistors.

o 1st differential cascade amplifier:

The 1st differential cascade amplifier is comprised of an emitter-connected differential current amplifier (U102-1/2, U202-1/2) and a current-to-voltage converter (U102-2/2, U202-2/2) which converts the differential collector output current of the differential current amplifier into a voltage signal. This amplifier also has the VARIABLE circuit for continuously-variable adjustment of the sensitivity between two adjoining vertical deflection sensitivity ranges selected by the VOLTS/DIV switch and the ×5 MAG switch for magnifying the vertical sensitivity by 5 times to realize the 1 mV/DIV sensitivity.

o VARIABLE circuit:

The VARIABLE circuit continuously-variably adjusts the vertical sensitivity by shunting with potentiometer RV104/RV204 a part of the collector current amplified by U102-1/2 or U202-1/2. Adjustment (attenuation) can be done with a ratio of 1/2.5 or over.

o ×5 MAG circuit:

The ×5 MAG function is to increase the vertical sensitivity by 5 times by switching the emitter resistor of the 1st differential cascade amplifier.

o 2nd differential cascade amplifier:

The 2nd differential cascade amplifier (Q105, 106, 110, 111, or Q205, 206, 210 - 213) amplifies the output of the 1st differential cascade amplifier to a sufficient level for driving the vertical switching circuit. The grounded-base stage (Q110, 111/Q209 - 212) of this cascade amplifier has a function of preventing the switching signal of the vertical switching circuit from being returned to the preceding stage and mixed into the trigger signal or the signal of the CH1 signal output amplifier. For the CH2 signal, this amplifier also has a function of inverting its polarity. This polarity inverting function is accomplished by switching with the INV switch the base grounding stages of Q210/213 and Q211/212 to which the collector currents which have been current-amplified by Q205 and Q206 are fed in a crossing manner.

Different from the case of the 1st differential cascade amplifier, the output signal of the 2nd differential cascade amplifier is fed directly in the form of the current signal to the diode gate of the vertical switching circuit. The current signal for vertical positioning of the trace on the CRT screen is added to the output current signal of the 2nd differential cascade amplifier, being controlled by potentiometer RV111/211 of the positioning circuit.

o Trigger signal amplifier (& CH1 signal output amplifier):

This circuit amplifies with its Q107, 108/Q207, 208 the signal picked off from the 2nd differential amplifier, and converts with its Q109 the collector output of Q107 into a low-impedance CH1 output signal which is fed to J-6C. The collector output signal of Q108/Q208 is fed as a trigger signal to the internal trigger signal switching circuit.

3.3 Vertical Switching Circuit

The vertical switching circuit is comprised of a vertical signal switching circuit (diode gate circuit) which electronically switches the vertical signals received from the CH1 and CH2 preamplifiers,

an internal trigger signal switching circuit which electronically switches the trigger signals, and a switching logic circuit which controls these switching circuits.

The vertical signal switching circuit is, as shown in Figure 3-3, comprised of a diode gate circuit, an ADD BAL circuit, and a switching buffer circuit which receives the signal from the diode gate circuit.

o Diode gate circuit:

The diode gate circuit (CR103 - 106, CR203 - 206) selects the CH1 and CH2 signals being controlled by the signal of the switching logic circuit according to the mode selected by the VERT MODE switch (S301).

For example, when the VERT MODE switch is set at CH1, the CH1 control signal becomes the Hi state, and the CH2 and CH3 control signals become Lo state. Consequently the output signal of the CH1 preamplifier is fed through CR103 and CR106 to the switching buffer circuit consisting of Q305 and Q306. The signals of the other channels are fed through respective diodes (CR204/205) to the control circuit. Thus, the signal of CH1 alone is fed to the switching buffer circuit and the signals of the remaining channels are blocked.

o ADD BAL circuit

When the ADD mode is selected by the VERT MODE switch, the control signals of both CH1 and CH2 become the Hi state, the signals of the CH1 and CH2 preamplifiers are fed through CR103/106 and CR203/206 to the switching buffer circuit, and the two signals are fed as their sum signal to the output circuit. The function of the ADD BAL circuit is to compensate for the DC balance shift caused by the above addition operation, with its ADD BAL control (semi-fixed potentiometer RV301).

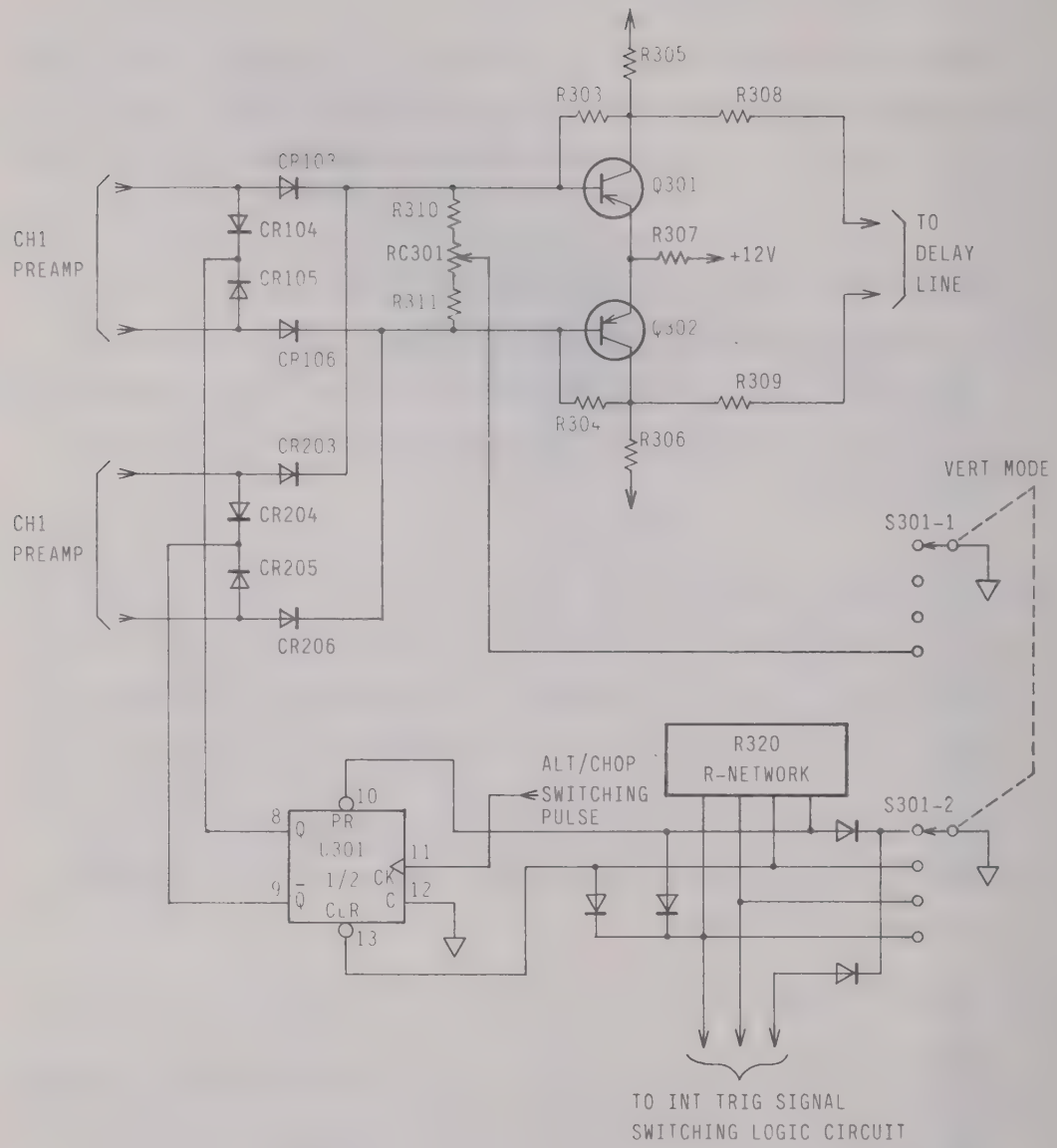

R305
R303
R308
CR103
Q301
CR104
R310
R307
+12V
TO
DELAY
LINE
CH1
PREAMP
CR105
RC301
R311
Q302
CR106
R309
R304
R306
CR203
VERT MODE
CR204
S301-1
CH1
PREAMP
CR205
CR206
R320
R-NETWORK
ALT/CHOP
SWITCHING
PULSE
S301-2
10
8
Q
PR
U301
11
1/2
CK
9
Q
CLR
C
12
13
TO INT TRIG SIGNAL
SWITCHING LOGIC CIRCUIT

Figure 3-3

o Internal trigger signal switching circuit:

The internal trigger signal switching circuit directly controls, with the control signal from the switching logic circuit, the diode gate circuit (CR107, 108, 207, 208) which is similar to the vertical signal switching circuit. The trigger signal which has passed the diode gate circuit is delivered as the internal trigger signal via connector P-7.

o Switching logic circuit:

The switching logic circuit is comprised of a vertical switching logic circuit which controls the vertical signal switching circuit and an internal trigger switching logic circuit which controls the internal trigger signal switching circuit.

The vertical switching logic circuit is comprised of a flip-flops (U301) with preset/clear terminal. Switching of channels can be done by turning on and off the preset/reset terminal of the flip-flop.

The internal trigger switching logic circuit controls the internal trigger signal switching circuit by switching it for the mode selected by the VERT MODE switch and TRIG SOURCE switch. This relationship is shown in the following table.

VERT MODE \ TRIG SOURCE	CH1	CH2
CH1	Triggered by CH1	
CH2	Triggered by CH2	
DUAL	Triggered by CH1	Triggered by CH2
ADD	Triggered by CH1	Triggered by CH2

3.4 Delay Line Circuit

The vertical signal which has passed the diode gate circuit is amplified by the switching buffer circuit (Q301, Q322). The switching buffer circuit drives the delay line, with a matched output impedance.

The delay line is used to provide a time delay for the signal. This delay line is used to prevent the trigger point of the signal from being lost from being displayed on the screen due to time lag in the horizontal deflection circuits or the Z-axis amplifier circuits. For the delay line, this oscilloscope employs a delay cable which provides a delay time of approximately 100 nanoseconds. The vertical signal which has passed the delay line is fed to the vertical output amplifier.

3.5 Vertical Output Amplifier

The vertical output amplifier is comprised of a delay line receiver which receives the output signal of the delay line with a matched impedance, and a final amplifier which drives the vertical deflection plates of the CRT.

- Delay line receiver circuit:

The delay line receiver circuit (Q305, 306) is a low input impedance negative feedback amplifier which, with its input resistors R331 and R332, provides impedance matching with the characteristic impedance (Zo ≒ 186 ohms) of the delay line.

- Final amplifier:

The final amplifier boosts the signal to a level sufficient for driving the vertical deflection plates of the CRT. It is comprised of a pair of feedback-type SEPP amplifiers.

Transistors Q307, 308/Q309, 310 current-amplify the signal to a level sufficient for driving transistors Q312, 313/Q314, 315. The signal which has been voltage-amplified by transistors Q417, 418/Q419, 420 is returned to the input circuit through the negative feedback circuit (R435/R436). The gain in this case is as follows:

$$Av = \frac{R346}{R388} \qquad Av' = \frac{R347}{R339}$$

Transistors Q311/Q316 are for the dynamic bias circuit which controls the bias current with respect to the repetition frequency of the signal in order to economize current consumption.

3.6 Trigger Generator

The trigger generator is comprised of a trigger pulse generator circuit which produces a trigger pulse signal for driving the sweep generator and an AUTO circuit which produces a free-run signal for automatic sweep operation when the trigger signal is asynchronized or no trigger signal is applied.

The trigger pulse generator circuit of the trigger generator is comprised of a source switch which selects a trigger signal source, a coupling switch which selects a coupling mode in conformity with the nature of the trigger signal source, an impedance converter circuit which converts the high-impedance trigger source signal into a low-impedance signal with which to drive the level comparator circuit which controls the start point (triggered point) of the signal waveform displayed on the CRT screen, a TV synchronization separator circuit which picks off the synchronization signal from the TV video signal, and Schmitt trigger circuits which convert the output signals of the level comparator circuit and TV synchronization signal separator circuit into TTL level signals.

o Source switch:

The source switch (S401) selects the internal trigger signal fed from Q401, the line trigger signal fed from R662, the external trigger signal fed from P-12. The selected signal is fed to the coupling switch.

o Coupling switch:

The coupling switch (S402-1) selects the coupling mode: It selects the DC mode for direct coupling of the signal fed from S401, the AC mode for discarding the DC component, or the HF REJ

mode for coupling via a low-pass filter. Switch S402-2 selects ON or OFF of the TV synchronization signal separator circuit which facilitates observation of a TV video signal.

o Impedance converter:

The impedance converter is a source follower (Q403) with FET. It converts the trigger signal selected by the source switch and coupling switch into a low-impedance signal, which is fed to drive the level comparator circuit (Q404, Q405).

o Level comparator:

The level comparator is a differential amplifier (Q404, 405), which adjusts the rise up portion (or the fall down portion) of the comparator output signal by applying the trigger source signal (the base signal of Q404) from the impedance converter circuit and applying the comparator level signal (the base signal of Q405) from the LEVEL control potentiometer (RV402-1). In this case, if switch S405 which is linked to the LEVEL control potentiometer is locked, the comparator level signal is applied to the base of Q405 from the level lock circuit and the trigger point is fed at the center amplitude of the trigger source signal.

The level lock circuit amplifies with its error amplifier (Q408, 409) the error signal detected by Q406 and Q407, and feeds back the signal so that the center level of the comparator output signal becomes the Schmitt level of the Schmitt trigger circuit.

It also selects a slope by switching the comparator output with the slope switch (S403-1).

The output signal of the level comparator is fed to the buffer amplifier which operates also as a signal separator circuit.

o Buffer amplifier/TV synchronization signal separator circuit:

This circuit operates either as a buffer amplifier or as a TV synchronization signal separator circuit, being selected by the transistor switching circuit (Q410, 411).

When Q410 is on and Q411 is off, the circuit operates as a buffer amplifier and amplifies the output signal of the level comparator to a level sufficient for driving the Schmitt circuit of the next stage.

When Q410 is off and Q411 is on, the circuit operates as a TV synchronization signal separator circuit and picks off the TV-H synchronization signal, which is pulsewidth-detected into a TV-V synchronization signal by the Schmitt circuit of the next stage.

- o TRIG Schmitt circuit:

The TRIG Schmitt circuit is a conventional circuit which generates a hysteresis voltage by applying a feedback signal with R440 to the two stages of NAND gates of 401. The output of the Schmitt circuit drives the A and B SWEEP generators and AUTO circuit.

- o AUTO circuit:

The AUTO circuit is comprised of a uni-junction transistor (UJT) circuitry made up by connecting mutually the bases and collectors of a PNP transistor (Q416) and an NPN transistor (Q415). This circuit converts the high-speed pulse output signal of the Schmitt circuit into a DC signal, with which to drive the A sweep generator.

3.7 A and B Sweep Generators

The A sweep generator produces the sawtooth signal for the main sweep (A sweep) of this oscilloscope. The B sweep generator produces the sawtooth signal for magnification in the time axis direction the waveform displayed on the main sweep or for display with a certain time delay (delayed sweep or B sweep).

The A sweep generator consists of the A sweep gate circuit which receives the trigger signal from the trigger generator and produces the sweep gate signal for starting sweeps, the sweep start comparator which maintains stably the sweep start point, the A sawtooth sweep generator which produces a sawtooth wave in conformity with the time constant selected by the TIME/DIV

switch, the sweep length circuit which controls the length of sweeps, the hold off circuit which controls the sweep return period and pause period, and the A sweep gate enable circuit which controls the sweep gate circuit in conformity with the AUTO, NORM or SINGLE mode as selected by the MODE switch for the signals of the above control circuits.

*: The B sweep generator is for the COS5041 only.

- A sweep gate:

The A sweep gate circuit employs a flip-flop TTL IC (U402-1/2) with preset/clear function. The trigger pulse of the trigger generator is applied to the CLOCK (Pin No. 1) terminal, the enable signal of the A sweep gate enable circuit to the CLEAR (Pin No. 15) terminal, and the enable signal and AUTO signal of the AUTO circuit to the PRESET (Pin No. 4) terminal through the NOR gate circuit. The Q (Pin No. 5) terminal output is applied as the unblanking signal to the Z-axis amplifier and the $\overline{Q}$ (Pin No. 6) terminal output is fed to the sweep start comparator circuit and becomes the A sweep gate signal. Even when no trigger pulse signal is applied to the CLOCK terminal, the $\overline{Q}$ output can be made the low state with the AUTO signal of the PRESET terminal so that the A sweep gate signal is generated and the circuit operates in the free-run mode.

- Sweep start comparator:

The sweep start comparator (Q419, 420) is a differential amplifier which lets the sweep gate signal pass and maintains constant the sweep start level. A start reference level identical with the B sweep start level is applied to one of the inputs, the Miller integrator output signal is applied to the other input, and the difference between the two signals is compensated for.

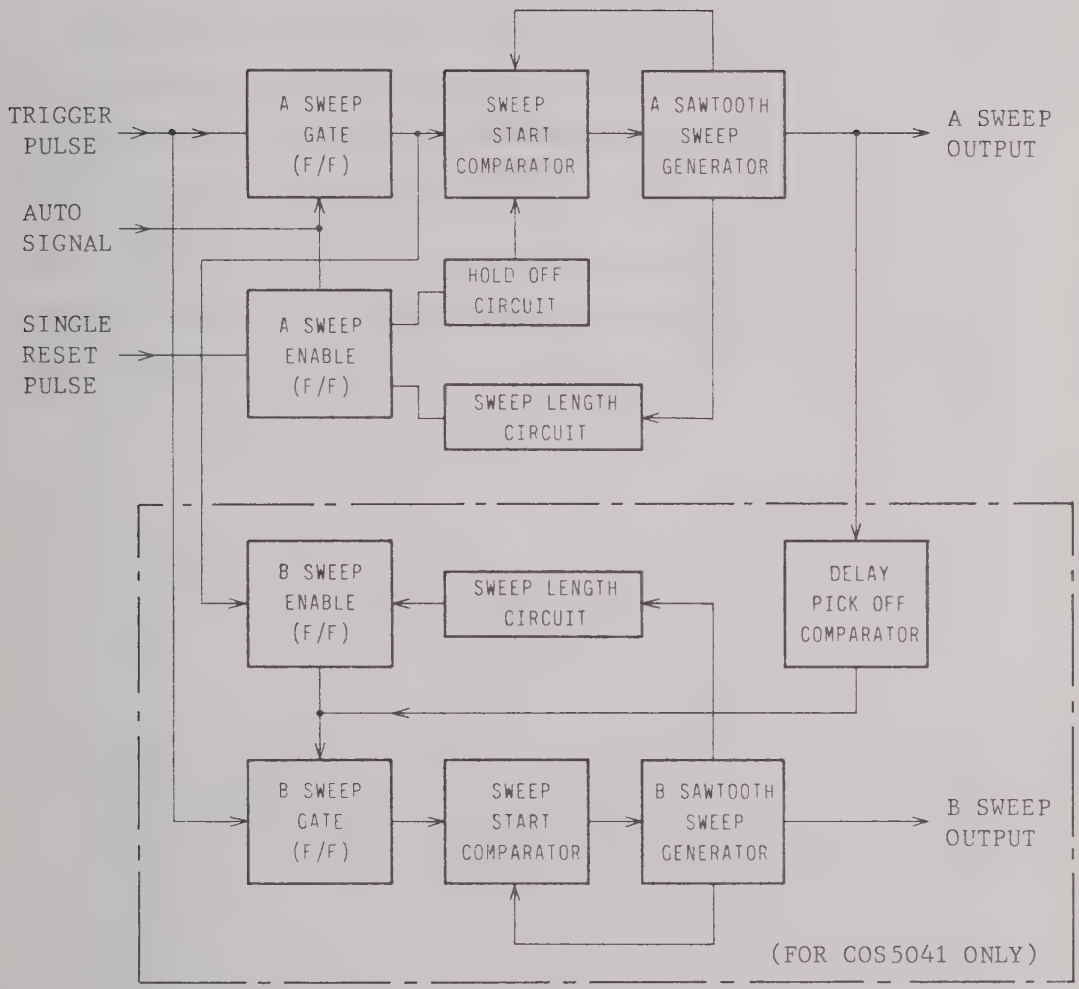

TRIGGER PULSE
AUTO SIGNAL
SINGLE RESET PULSE
A SWEEP GATE (F/F)
SWEEP START COMPARATOR
A SAWTOOTH SWEEP GENERATOR
A SWEEP OUTPUT
HOLD OFF CIRCUIT
A SWEEP ENABLE (F/F)
SWEEP LENGTH CIRCUIT
B SWEEP ENABLE (F/F)
SWEEP LENGTH CIRCUIT
DELAY PICK OFF COMPARATOR
B SWEEP GATE (F/F)
SWEEP START COMPARATOR
B SAWTOOTH SWEEP GENERATOR
B SWEEP OUTPUT
(FOR COS5041 ONLY)

Figure 3-4

o A sawtooth generator:

The A sawtooth generator is comprised of a gate transistor amplifier, a Miller integrator, an integration time constant switching circuit, and a TIME/DIV switch which controls the switching circuit. The gate transistor amplifier (Q423) controls the Miller integrator circuit in such manner that the start level control signal and sweep gate signal of the sweep start comparator do not affect the integration time constant. The Miller integrator (Q425) produces a sawtooth signal with the time constant selected by the integration time constant selector circuit. The integration time constant selector circuit selects integration capacitor C459/C460 with Q426. For integration current, resistor array (R491, 492, 493) is directly selected by the TIME/DIV switch (S406-1).

o Sweep length circuit:

This circuit divides the A sweep generator output by R461/R462 and shapes the waveform with Q418 to obtain a sweep length signal.

o Holdoff circuit:

The holdoff circuit generates a holdoff (pause) time signal proportional to the sweep time by producing a triangular wave with an integrator circuit and making use of the rise time of the triangular wave. The integrator, with its Q421, selects the time constant in accordance with the integration output voltage in order to cover a wide time range. The output signal of the integrator circuit is shaped by Q417 into a holdoff signal.

o A sweep gate enable circuit:

The A sweep gate enable circuit employs the flip-flop IC (U402-2/2) which makes up a pair with the A sweep gate circuit. The holdoff signal is applied to the PRESET (Pin No. 10) terminal, the length signal is applied to the CLEAR (Pin No. 14) terminal, and the enable signal is delivered from the Q (Pin No. 9) terminal. This enable signal presets or clears the A sweep gate circuit.

When in the NORM sweep mode, the output signal of the AUTO circuit is blocked and, if no trigger signal is applied, the circuit is in the ready state. When in the SINGLE sweep mode, the holdoff circuit remains idle and a one-shot sweep is effected by the reset signal applied from the CLOCK (Pin No. 13) terminal.

This paragraph is applicable to the COS5041 only: The basic structure of the B sweep generator is identical with that of the A sweep generator. It consists of the B sweep gate, sweep start comparator, B sawtooth generator, sweep length circuit, B sweep enable circuit, and delay pickoff comparator. The B sweep generator requires no holdoff circuit because it operates only during the period the A sweep generator is in the sweep operation. Instead of the holdoff signal, the A sweep gate signal sets the B sweep enable circuit to the enable state.

o Delay pickoff comparator:

The delay pickoff comparator (Q702 - 704) employs a differential comparator to obtain a certain time relationship as set by the delay time multiplication potentiometer (RV701) with respect to the A sweep signal. The comparator compares the A sweep output signal (sawtooth waveform) with the voltage set by RV701, generates a delayed sweep start signal, and sets the B sweep gate circuit to start the B sweep signal. When in the B TRIG'D mode, the B sweep gate circuit is not set directly with this delayed sweep start signal but the PRESET (Pin No. 4) terminal is set to the high state and the B sweep signal is started as driven by the trigger pulse of the trigger generator.

3.8 Horizontal Switching Circuit

The horizontal switching circuit is comprised of a switching buffer circuit which prevents switching distortion from being sent to the sweep circuit of the preceding stage, a display switching circuit which electronically switches the A and B sweep signals and CH1 HOR (X) signal, and a display switch (S702) to control these circuits. (The display switch is for the COS5041 only.)

o Switching buffer circuit:

The switching buffer circuit is of a grounded-base-type amplifier. Transistor Q430 is for buffer-amplification of the A sweep signal, transistor Q712 for the B sweep signal.

o Display switching circuit:

The display switching circuit, with its analog signal multiplexer IC (U404), selects the A and B sweep signals and CH1 HOR (X) signal.

3.9 · Horizontal Output Amplifier

The horizontal output amplifier consists of a drive amplifier which selects between NORM and ×10 MAG mode for the horizontal signal received from the horizontal switching circuit and drives the output amplifier, and an output amplifier which drives the horizontal deflection plates of the CRT.

o Drive amplifier:

The drive amplifier (Q501 - 504) converts the horizontal signal received from the horizontal switching circuit into a differential signal, with which to drive the output amplifier. With Q501 and 502, gain of the differential amplifier can be multiplied by a factor of 10 for the ×10 MAG function.

o Output amplifier:

The output amplifier (Q505 - 512) is comprised of feedback-type SEPP amplifiers symmetrical for right and left which provide sufficient speed and output voltage for driving the horizontal deflection plates of the CRT. The signal cirrent-amplified by Q505/Q506 is converted into a voltage signal by Q507 - Q512 to obtain a sufficiently high gain and a sufficiently low output impedance. By means of negative feedback resistor R518/R519 a stable gain and wide and flat frequency response are attained.

3.10 Z-axis Amplifier

The Z-axis amplifier is comprised of an input circuit and an output amplifier. The input circuit merges the unblanking signals of the A and B sweep generators, the external intensity modulation signal applied through the Z-axis input terminal, the B intensity control signal, and the overall intensity control signal. The output amplifier amplifies the merged signal into a sufficient level for driving the G1 grid of CRT.

- Input circuit:

The input circuit merges the unblanking signals of the A and B sweep generators, the chopped blanking signal, the external intensity modulation signal applied via the X-axis input terminal, and the overall intensity control signal. The resultant compound signal is fed to the output amplifier.

- Output amplifier:

The output amplifier amplifies the above compound signal to several tens volts. It is of a feedback-type SRPP circuit (Q654, 656, 658). This amplifier also generates (with its Q655, 657, 659) a linear focus signal which is in the inverted phase of the unblanking signal. The amplified unblanking output signal and linear focus signal are fed to the G1 and P1 of the cathode-ray tube through the CRT circuit to drive the intensity and focus of the displayed waveform.

3.11 CRT Control Circuit

The CRT control circuit is comprised of a DC regeneration circuit which converts the linear focus signal and the unblanking output signal of the Z-axis amplifier into the operating-voltage signals of the CRT in order to be applied to the focus electrode and G1 electrode of the CRT, semi-fixed potentiometers ASTIG (RV652), GEOMETRY and SUB-FOCUS (RV651), a trace rotation circuit for adjusting the trace direction in parallel with the horizontal graticule lines, and an illumination circuit for illuminating the graticule.

o DC regeneration circuit:

The DC regeneration circuit converts the linear focus signal and unblanking signal of several tens to several hundreds volts into AC signals with the switching signal of the DC-DC converter circuit, and then converts them back into DC signals with respect to the cathode voltage and focus reference voltage of the sub-focus potentiometer in order to provide a focus signal and an unblanking signal of the operating voltages of the CRT.

3.12 HV Regulator (High Voltage Generator)

The high voltage generator produces an acceleration voltage (-1800 V) applied to the CRT cathode and a post-acceleration voltage (approximately +10 kV) applied to the CRT anode to accelerate the electron beam which has passed the X and Y deflection plates and mesh electrode. The circuitry is a DC-DC converter with blocking oscillator (Q651), with resonance of the secondary coil winding. The high voltage of approximately 3600 Vp-p (frequency approximately 30 kHz) generated by the blocking oscillator is 6-times voltage-multiplication rectified by a Cockcroft circuit into a positive voltage of approximately 10 kV and it is half-wave rectified into a negative voltage of -1800 V.

This DC-DC converter feeds the negative voltage of -1800 V via a high resistance circuit (R661, R662) to the control circuit (U651) to obtain a stabilized acceleration voltage. It also is fed through a capacitor-coupling circuit to the DC regeneration circuit in order to be used as the switching signal.

3.13 Power Supply Circuit

The power supply circuit steps up or down with its power transformer the AC line voltage into various voltages and rectifies them to DC supply voltages for the various circuits of the oscilloscope. The primary winding of the power transformer is of a split type, in order that the oscilloscope can be operated on various AC line voltages by connecting the transformer taps in series or parallel as required by means of the line voltage

selector plug (P-47). Regarding the secondary circuit, the transformer has one 6.3 V winding for the CRT heater and two windings of different voltages for different circuits of the CRT. The AC voltages of the two windings are rectifies and supplied as regulated +16 V power and non-regulated +145 V, +12 V, +5 V, and -12 V powers.

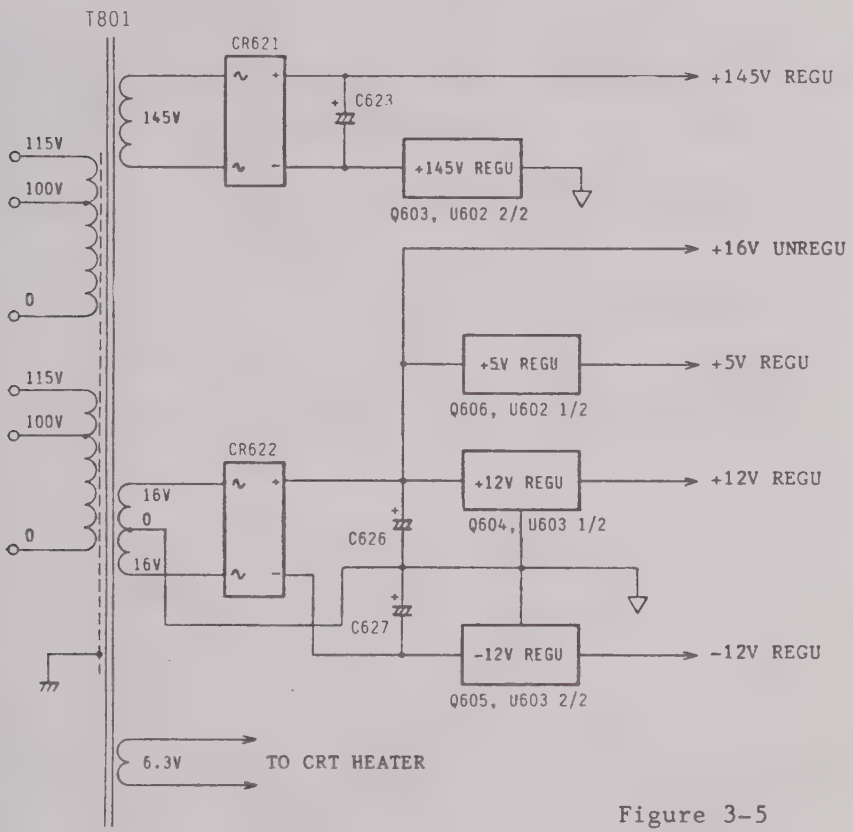


Figure 3-5

3.14 Calibrator Circuit

The calibrator circuit provides square-wave calibration voltage signal of 2 Vp-p which is used for calibration of the probe and the amplifiers when they are operated in the non-calibrated mode. The voltage accuracy of the calibration signals is 2% or better. The calibration signal is produced by generating a signal with the multivibrator of CMOS IC (U1601 1/4, 2/4), shaping the waveform with the Schmitt circuit of CMOS IC (U1601 3/4, 4/4), and dividing the voltage signal with resistors.

4. CALIBRATION

4.1 General

After the oscilloscope has been used for a period of time, it should be calibrated. Although calibration of overall performances is recommended, partial calibration may serve the purpose as that the time axis alone is calibrated when the time measuring accuracy is especially important or that the vertical axis alone is calibrated when the vertical sensitivity accuracy is of prime importance. After the oscilloscope has been repaired, overall calibration is suggested although it depends on the type of repair. For accurate calibration service, contact your Kikusui agent.

4.2 Removing the Case

To remove the case, remove the nine screws (Figure 4-1) and detach the top panel upward and the bottom panel downward.

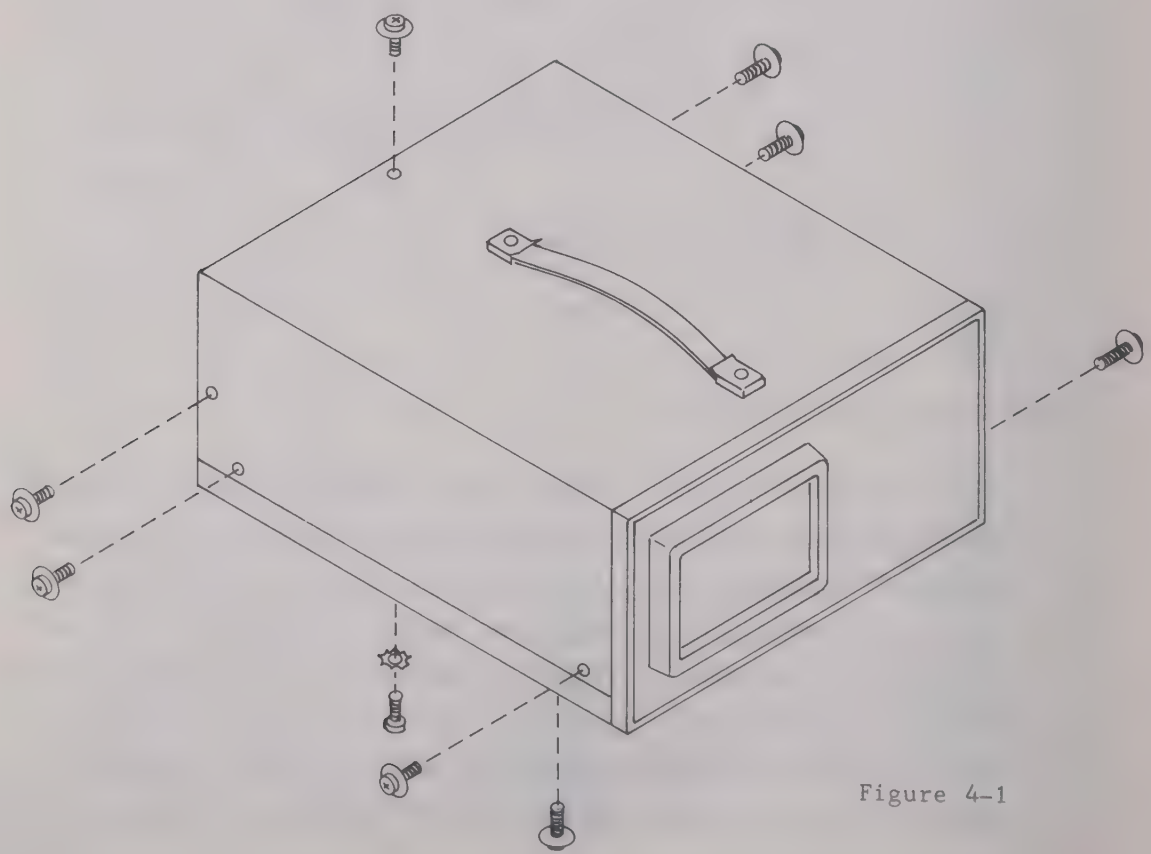


Figure 4-1

4.3 Check and Adjustment of DC Supply Voltages

Before calibrating the oscilloscope, its DC supply voltages should be checked and adjusted. Check and adjust the +12V supply voltage first and the other supply voltages next. The supply voltages are shown in the following table and the check and adjustment points are indicated in Figure 4-2.

Nominal voltage	Tolerance	Check and adjustment points
+5 V	+4.75 to +5.25 V	
+12 V	+11.95 to +12.05 V	RV606 (Figure 4-2)
-12 V	-11.80 to -12.20 V	
+145 V	+140 to +150 V	
-1800 V	-1750 to -1850 V	P36, Pin No. 3 (Figure 4-5)

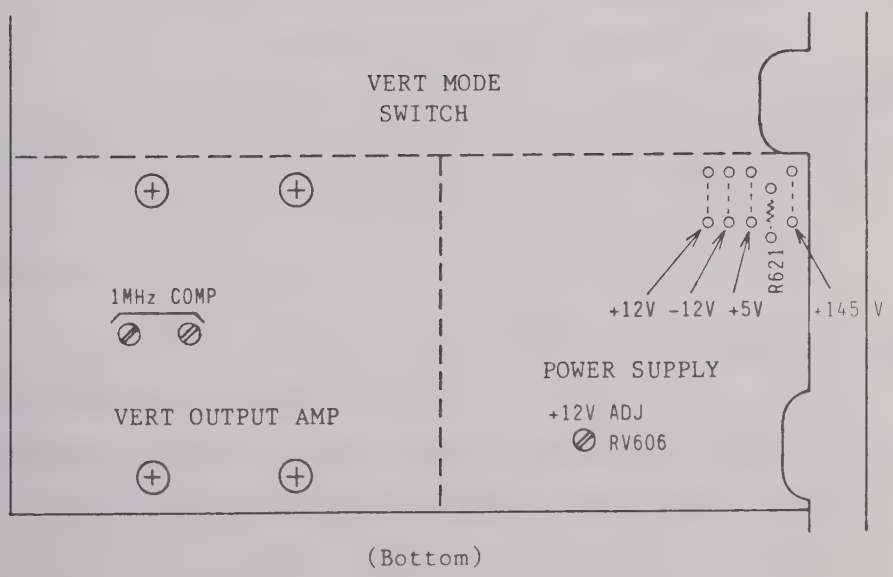


Figure 4-2 A1 printed circuit board

For voltage check, measure the voltage between check point and ground using precision digital voltmeter. The +12V supply must be especially carefully adjusted because it provides a reference for other supplies. To measure the -1800V supply of which internal impedance is high, use a voltmeter which as a sufficiently high input impedance (10 MΩ or over).

Because adjustments of supply voltages largely affect vertical sensitivity and horizontal sweep time, the oscilloscope must be re-calibrated as explained in the subsequent paragraphs.

4.4 Adjustment of CRT Circuits

Some adjustments of the CRT circuits directly affect the CRT deflection sensitivity as is the case of "Check and Adjustment of DC Supply Voltages" of the preceding section.

- o Adjustment of SUB INTEN:

This control is for adjusting the trace intensity and the operating position of the INTEN knob (4).

(1) Set the TIME/DIV switch (30) at 1 mS and display a single-line horizontal trace on the screen.

(2) Set the white mark of the INTEN knob at the 10 o'clock position and so adjust the SUB INTEN control (Figure 4-5, RV653) that the trace is displayed on the screen with a barely discernible intensity.

- o Adjustment of SUB-FOCUS:

This control is for adjusting the control range position of the FOCUS knob (6). With the FOCUS knob set with its white dot positioned upright (noon position), so adjust the SUB-FOCUS control (Figure 4-5, RV651) that the best focus is obtained.

o Adjustment of ASTIG:

This control is for focus adjustment of the electron lens of the CRT.

(1) Set the TIME/DIV switch (30) to the [X-Y | EXT HOR] position and display the beam spot in the center of the CRT screen with the POSITION controls.

(2) Turn the FOCUS control (6) to an appropriate position and then adjust the ASTIG control (Figure 4-5, RV652) so that the shape of the displayed beam spot becomes as true circle as possible.

4.5 Adjustment of Vertical Axis

o Adjustment of STEP BAL:

This control is for minimizing the shift of trace when the VOLTS/DIV switch (12) or (16) is turned from the 5 mV position to the 10 mV position.

(1) Set the AC-GND-DC switch (10) or (19) and display the trace on the CRT screen.

(2) Turning the VOLTS/DIV switch between 5 mV and 10 mV positions, so adjust the STEP BAL control (Figure 4-6, RV101 or RV201) that the shift of trace becomes minimum.

o Adjustment of ×5 MAG BAL:

This control is for minimizing the shift of trace when the ×5 MAG switch (13) or (17) is changed.

(1) Set the AC-GND-DC switch (10) or (19) in the GND state and display a trace on the screen.

(2) Turning on and off the ×5 MAG switch, so adjust the MAG DC BAL control (Figure 4-6, RV112 or RV212) that the shift of trace becomes minimum.

o Adjustment of VAR DC BAL:

This control is for minimizing the shift of the trace when the VARIABLE KNOB (13) or (17) is turned.

(1) Set the AC-GND-DC switch (10) or (19) in the GND state and display the trace on the CRT screen.

(2) Turning the VARIABLE knob, so adjust the VAR DC BAL control (Figure 4-6, RV105 or RV205) that the shift of the trace becomes minimum.

o Sensitivity calibration of CH1 and CH2:

Calibrate the sensitivity of the vertical amplifier to the value indicated by the VOLTS/DIV switch (12) or (16). For this adjustment, use a square wave generator with an output voltage setting accuracy of 0.3% or better, at 1 kHz.

(1) Set the signal generator output at 80 mVp-p and apply the signal to the vertical input terminal (11) or (18).

(2) Set the VARIABLE knob (13) or (17) at the CAL'D position and set the VOLTS/DIV switch at the 10 mV range.

(3) So adjust the CH1 or CH2 GAIN control (Figure 4-6, RV110 or RV210) that the amplitude of the displayed waveform becomes 8 DIV.

By the above procedure, other ranges also are calibrated to an accuracy of ±3% or better.

o Sensitivity calibration of ×5 MAG:

In a similar manner as for sensitivity calibration of CH1 and CH2, calibrate the sensitivity for the ×5 MAG function.

(1) Set the signal generator output at 16 mVp-p and apply the signal to the vertical input terminals (11) and (18).

(2) Set the VARIABLE knob (13) or (17) at the CAL'D position, set the VOLTS/DIV switch (12) or (16) at the 10 mV range, and pull out the CH1 ×5 MAG switch (13) or (17).

(3) So adjust the CH1 or CH2 GAIN control (Figure 4-6, RV102 or RV202) that the amplitude of the displayed waveform becomes 8 DIV.

By the above procedure, other ranges also are calibrated to an accuracy of ±5% or better.

o Adjustment of ADD BAL:

With both CH1 and CH2 channels operating in a single-line horizontal trace state at the center of the screen, so adjust this control that the traces do not shift even when the VERT MODE switch is changed to the ADD mode.

(1) Set the AC-GND-DC switches (10) and (19) in the GND state and display the traces of the two channels overlapped at the center of the screen.

(2) Change the VERT MODE switch to the ADD state and so adjust the ADD BAL control (Figure 4-6, RV301) that the traces are positioned at the center of the screen.

o Adjustment of square wave characteristics of vertical amplifiers:

This adjustment is to adjust the square wave characteristics of the vertical amplifiers and to make their frequency response flat. This adjustment should be done at a range which does not use the input attenuator (10 mV/DIV range), using a square wave of 1 MHz.

Adjustment should be done using a quality square wave with a rise time of 1.0 nsec or faster, in the order of middle and high ranges, repeating adjustment for a few times.

(1) Adjustment for middle frequency range:

Set the VOLTS/DIV switch at 10 mV/DIV and the TIME/DIV switch at 20 μS/DIV. Apply to the vertical input terminal a square wave of 1 MHz and so adjust the signal generator output that the waveform is displayed with an amplitude of 6 DIV.

Then, so that the waveform becomes as shown in Figure 4-3 (b), adjust RV302 and C331 (Figure 4-6) first and RV109 and C171 (RV209 or C271 for CH2) next.

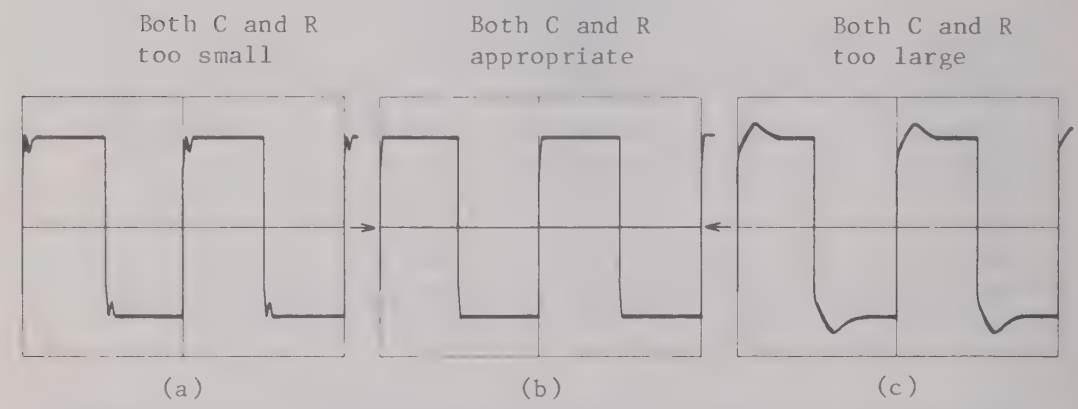


Figure 4-3

(2) Adjustment for high frequency range:

This adjustment is to make still more sharp the leading edge and reduce ringing at the leading edge of the pulse waveform which has been adjusted in step (1).

For this adjustment, adjust CH1 and CH2 to the same characteristics.

Change the TIME/DIV switch to the 0.2 μS/DIV position and expand the front edge of the pulse waveform which has been adjusted in step (1) "Adjustment for middle frequency range." Next, adjust RV103 and C131 (RV203 and C231 in the case of CH2) so that the leading edge of the pulse waveform becomes sharp.

Repeat the above adjustment so that flat square wave characteristics with sharp leading edge is obtained and the difference between CH1 and CH2 becomes minimum.

After the above adjustment is done, check again that the frequency response characteristics of both channels are satisfactory.

o Adjustment of input ATT of CH1 and CH2:

The VOLTS/DIV switch selects the oscilloscope sensitivity by switching the attenuator circuit consisting of the 1st attenuator (1/1, 1/10, 1/100 steps) and the 2nd attenuator (1/1, 1/2, 1/4, 1/10 steps). This procedure is for phase compensation and input capacitance adjustment of the attenuators. Adjustments should be done in the order of phase compensation and input capacitance adjustment.

Use a square wave signal generator which provides a quality square wave of rise time 1 μsec or faster, without sags or overshoots. Apply the signal for each of the ranges (0.1 V, 1 V) and display a waveform with an amplitude of 6 DIV. So adjust the phase compensation capacitors shown in the following table (see Figure 4-6) that an ideal waveform is displayed. Next, connect a low-capacitance C-meter to the input terminal and so adjust the input-capacitance compensation capacitor that the input capacitance at each range becomes 25 pF ±2 pF.

Compensation capacitor / Range	CH1		CH2	
	Phase compensation	Input capacitor	Phase compensation	Input capacitor
0.1 V (1/10)	C103	C102	C203	C202
1 V (1/100)	C106	C105	C206	C205

o Adjustment of CH1 SIGNAL OUTPUT DC OFFSET:

* This adjustment must be made after "Adjustment of CH1 TRIG OFFSET" of Section 4.6 has been done.

This adjustment is to make zero the DC offset of the CH1 signal output with the DC OFFSET control.

(1) Apply the CH1 signal output to the CH2 input terminal using a coaxial cable.

(2) Display the CH2 input signal on the screen and set the VOLTS/DIV switch at the 10 mV range.

(3) Changing the CH2 input coupling switch between GND and DC, so adjust the CH1 SIGNAL DC OFFSET control RV108 (Figure 4-6) that shift of the trace becomes zero.

4.6 Adjustment of Trigger Circuit

o Adjustment of CH1 TRIG DC OFFSET:

This adjustment is for offsetting to zero the DC-component displacement of the CH1 internal trigger output.

(1) Apply a sinusoidal signal of approximately 1 kHz to the CH1 input terminal and set the AC-GND-DC switch at AC.

(2) Set the VERT MODE switch at CH1, set the INT TRIG switch at CH1 or ALT, and display the signal with an amplitude of 8 DIV on the screen.

(3) Set the COUPLING switch at AC and so adjust the LEVEL knob that the trigger point is brought to the center of the displayed waveform amplitude.

(4) Change the COUPLING switch to DC and so adjust the CH1 TRIG & X-AXIS DC OFFSET (Figure 4-6, RV107) that the trigger point is brought to the center of the displayed waveform amplitude.

o Adjustment of CH2 TRIG DC OFFSET:

This adjustment is for offsetting to zero the DC-component displacement of the CH2 internal trigger output.

For this adjustment, adjust CH2 TRIG DC OFFSET (Figure 4-5, RV207) in a similar manner as is the case of "Adjustment of CH1 TRIG DC OFFSET."

4.7 Adjustment of Time Base

o Calibration of A sweep time:

This adjustment is for calibrating the sweep time to the values indicated by the TIME/DIV switch (30). For this adjustment, use time marker signals of accurate time intervals of 1 msec and 1 μsec or use signals of accurate frequencies of 1 kHz and 1 MHz.

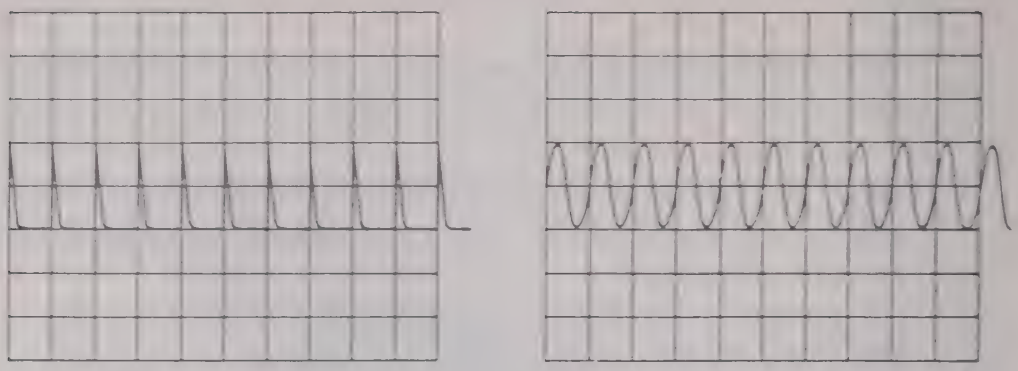
(1) Apply to the vertical input terminal a time marker signal of 1 msec or sinusoidal wave signal of 1 kHz and set the TIME/DIV switch (30) at 1 mS.

(2) So adjust the 1 mS CAL (Figure 4-5, RV405) that the displayed signal waveform conforms with scale divisions of the graticule.

(3) Next, change the input signal to a 1-μsec time marker signal or a 1-MHz repetitive frequency signal and change the TIME/DIV switch indication to 1 μS.

(4) So adjust RV404 (Figure 4-5) that the displayed signal waveform conform with scale divisions of the graticule.

When the above calibration is complete, the sweep speeds of the remaining ranges of the TIME/DIV switch (30) also are calibrated to an accuracy of ±2% or better.



Time marker signal　　Sinusoidal wave signal

Figure 4-4

o Calibration of B sweep time (for COS5041 only):

Calibrate the sweep time to the indicated values of the TIME/DIV switch (33). Adjust 1μS (Figure 4-5, RV703) in a similar manner as that for the case of "Calibration of A sweep time."

o Adjustment of sweep start points (for COS5041 only):

This adjustment is for aligning the start points of the A and B sweeps.

(1) Set the TIME/DIV switches (30) and (33) at 0.5mS, set the DISPLAY switch (29) at ALT, and display the A trace on the screen.

(2) So adjust the horizontal POSITION knob (32) that the start point of the A trace is brought to the left hand end of the graticule.

(3) Next, with the B SWEEP START POSITION control (Figure 4-5, RV702), bring the start point of the B trace to the left hand end of the graticule.

4.8 Adjustment of Horizontal Axes (X-axis)

o Calibration of horizontal sensitivity:

This adjustment is for calibration of the X-axis sensitivity for X-Y operation.

After this adjustment is done, "Adjustment of CH1 SIGNAL OUTPUT DC OFFSET" of Section 4.5 and "Adjustment of CH1 TRIG DC OFFSET" of Section 4.6 must be done.

(1) Set at 100 mVp-p the output of the signal generator used for "Calibration of sensitivity" of Section 4.5, and apply the output to the CH1 (X) input terminal (11) .

(2) Set the TIME/DIV switch (30) at [X-Y | EXT HOR], the SOURCE switch (26) at [X-Y], the COUPLING switch (25) at DC, and the VERT MODE switch (14) at [X-Y].

(3) So adjust the X-GAIN control (Figure 4-6, RV106) that the horizontal length of the trace becomes 10 DIV.

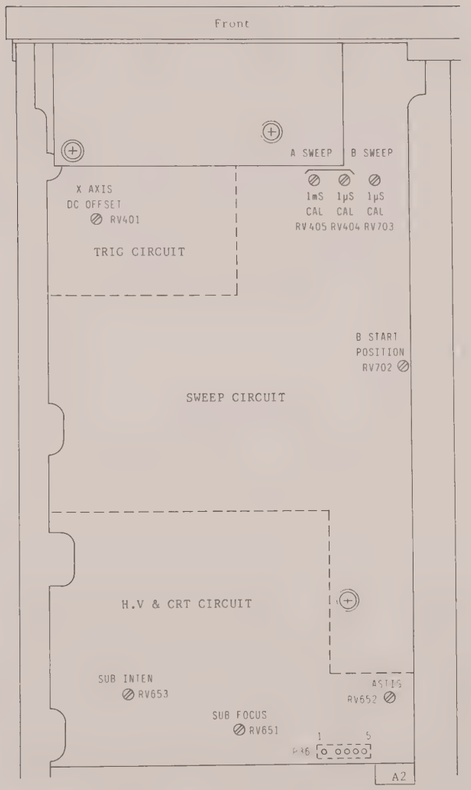
o Adjustment of X-Y POSITION ADJ:

This adjustment is for adjusting the positional relationship for the ↔ POSITION control when operation is switched between the NORM sweep mode and the [X-Y | EXT HOR] mode.

(1) Set the TIME/DIV switch (30) at 1 mS/DIV. Align the start point of the sweep with the left hand end of the CRT graticule with the ↔ POSITION control (32) .

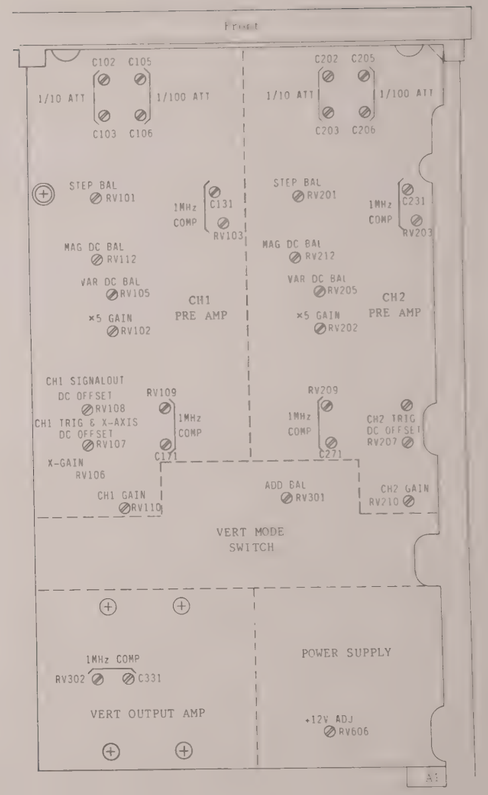
(2) Change the TIME/DIV switch (30) to the [X-Y | EXT HOR] to select the X-Y mode.

(3) So adjust the X-AXIS DC OFFSET control (Figure 4-5, RV401) that the beam spot is positioned at the center of the CRT graticule.



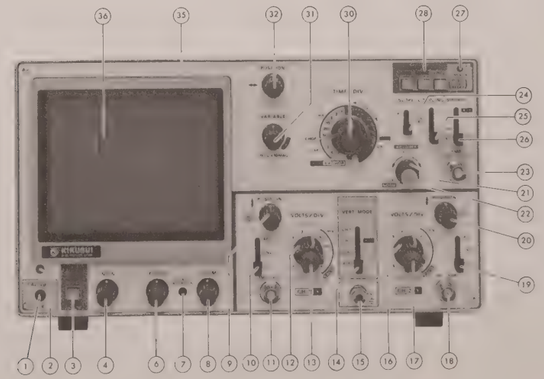
UPPER PRINTED CIRCUIT BOARD

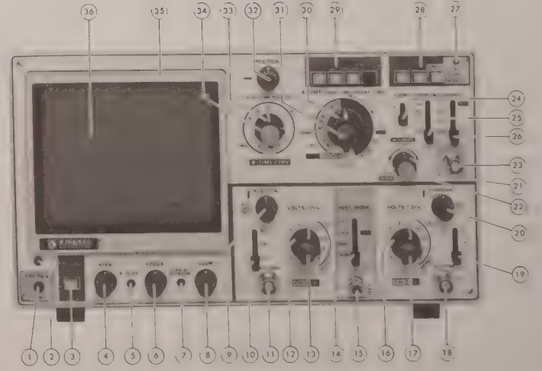
Figure 4-5

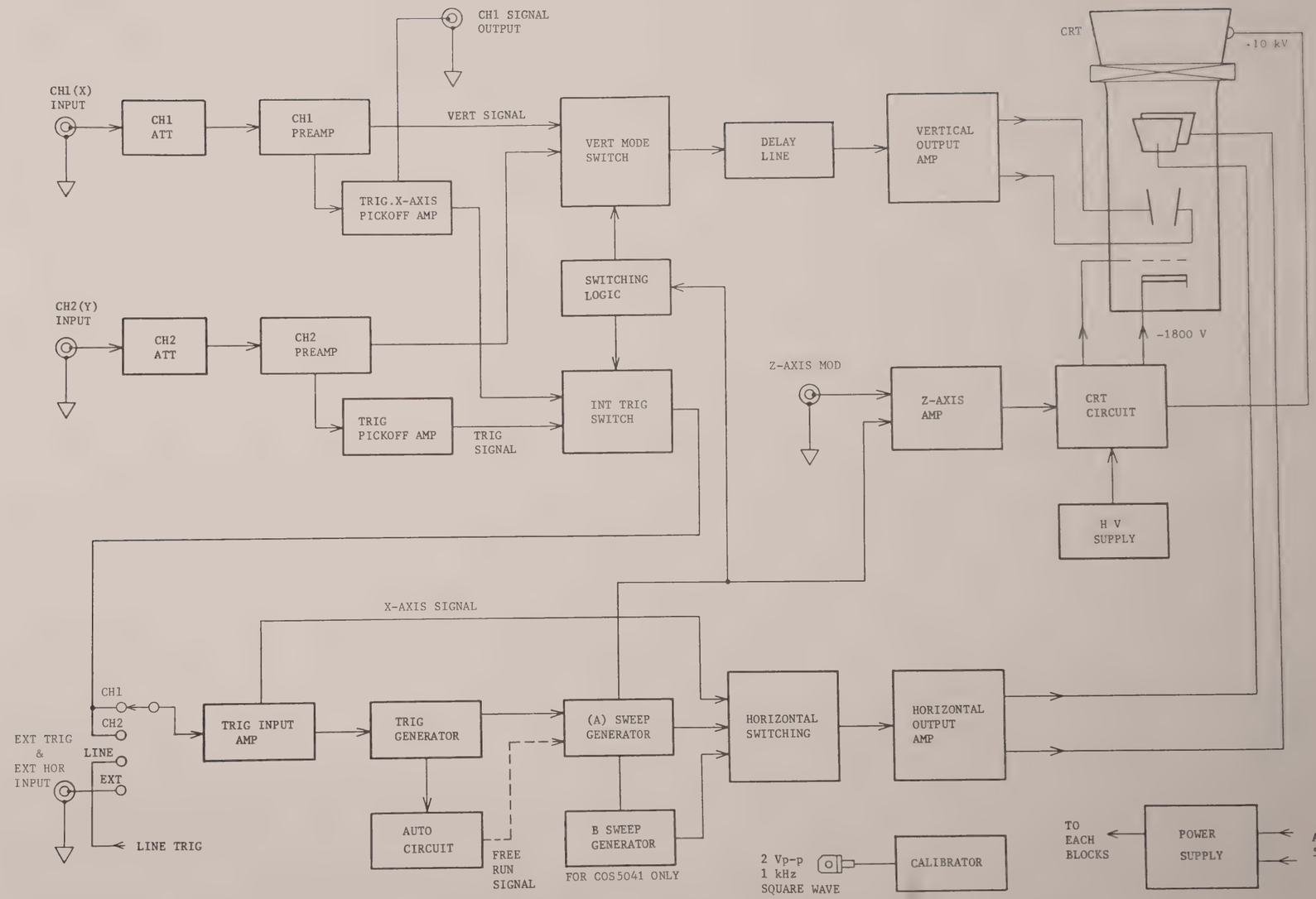


LOWER PRINTED CIRCUIT BOARD

Figure 4-6







BLOCK DIAGRAM

CIRCUIT SCHEMATICS

MODEL COS5040

VERTICAL AMPLIFIER ◇1

TRIG & SWEEP GENERATOR ◇2

CRT CIRCUIT & POWER SUPPLY ◇3

MODEL COS5041

VERTICAL AMPLIFIER ◇1

TRIG & SWEEP GENERATOR ◇2

CRT CIRCUIT & POWER SUPPLY ◇3

NOTES

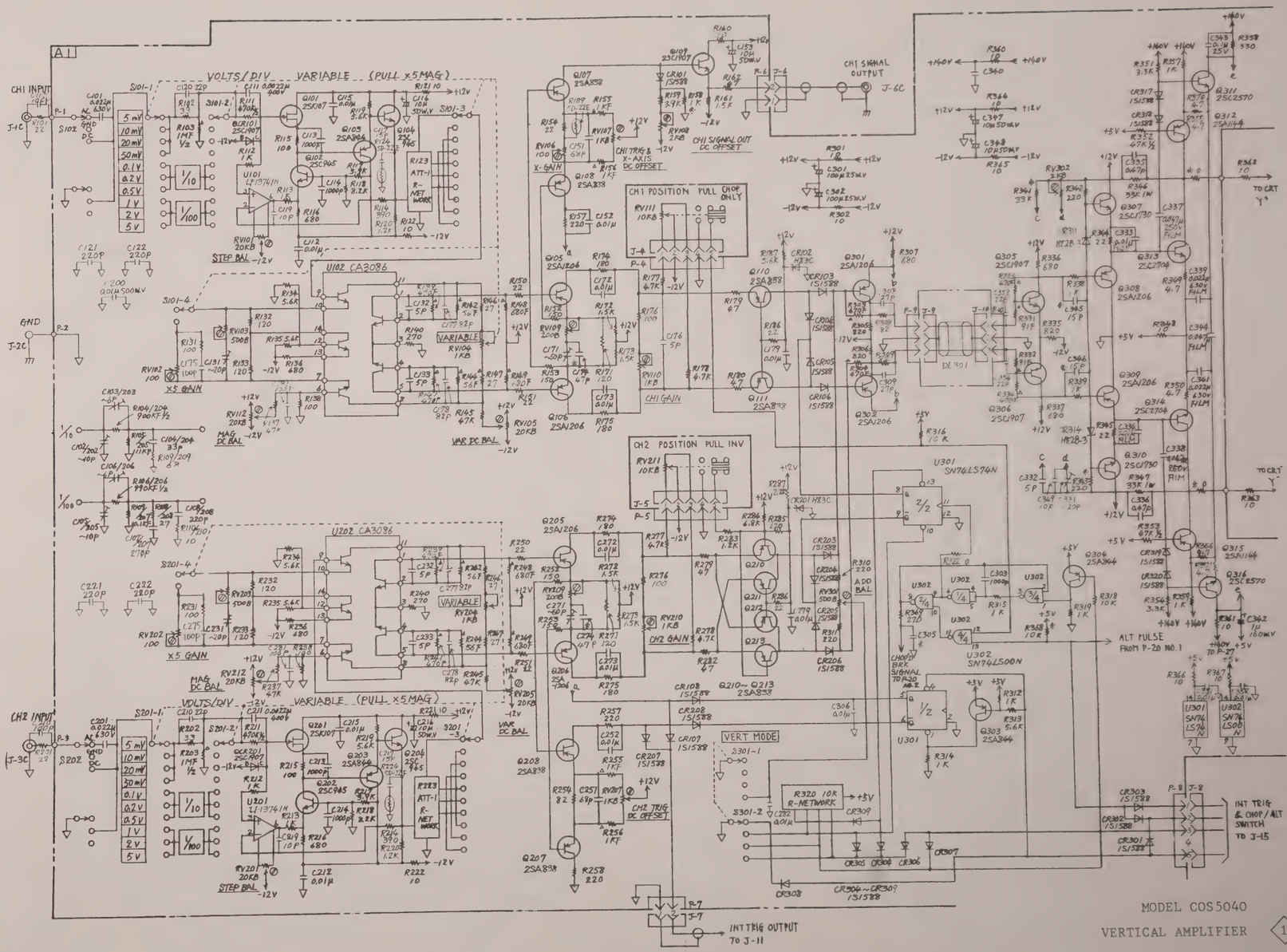
Diodes, transistors and ICs of type numbers different from those indicated but of equivalent characteristics may be used.
Unless otherwise indicated, resistance is given in ohms, 1/4W, 5%, carbon film and capacitor is given in farads.

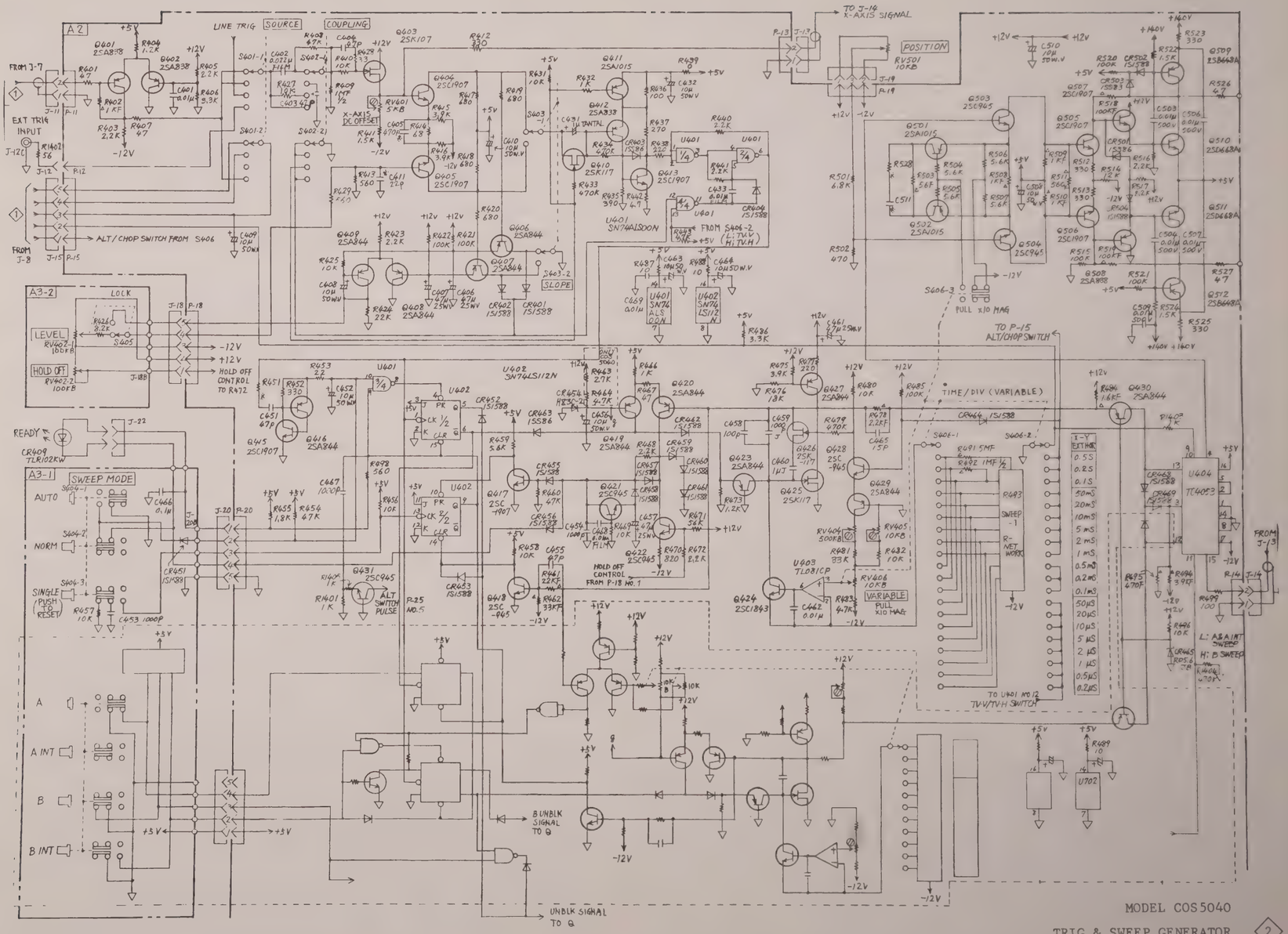
* Optimum value selected at factory. Average value shown.

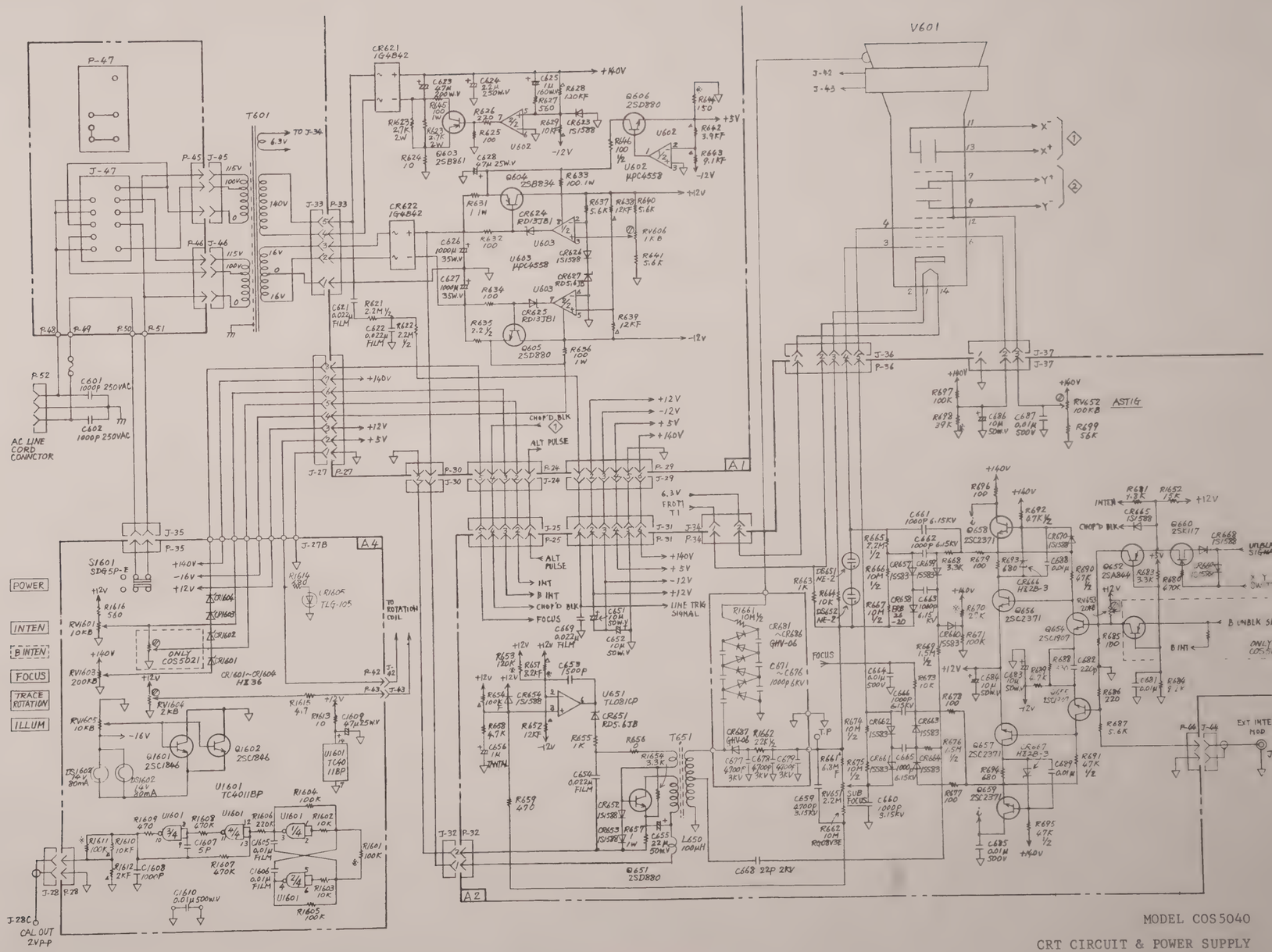
(Parts may be omitted.)

△ Metal film resistor.

⊘ Screwdriver adjustment.

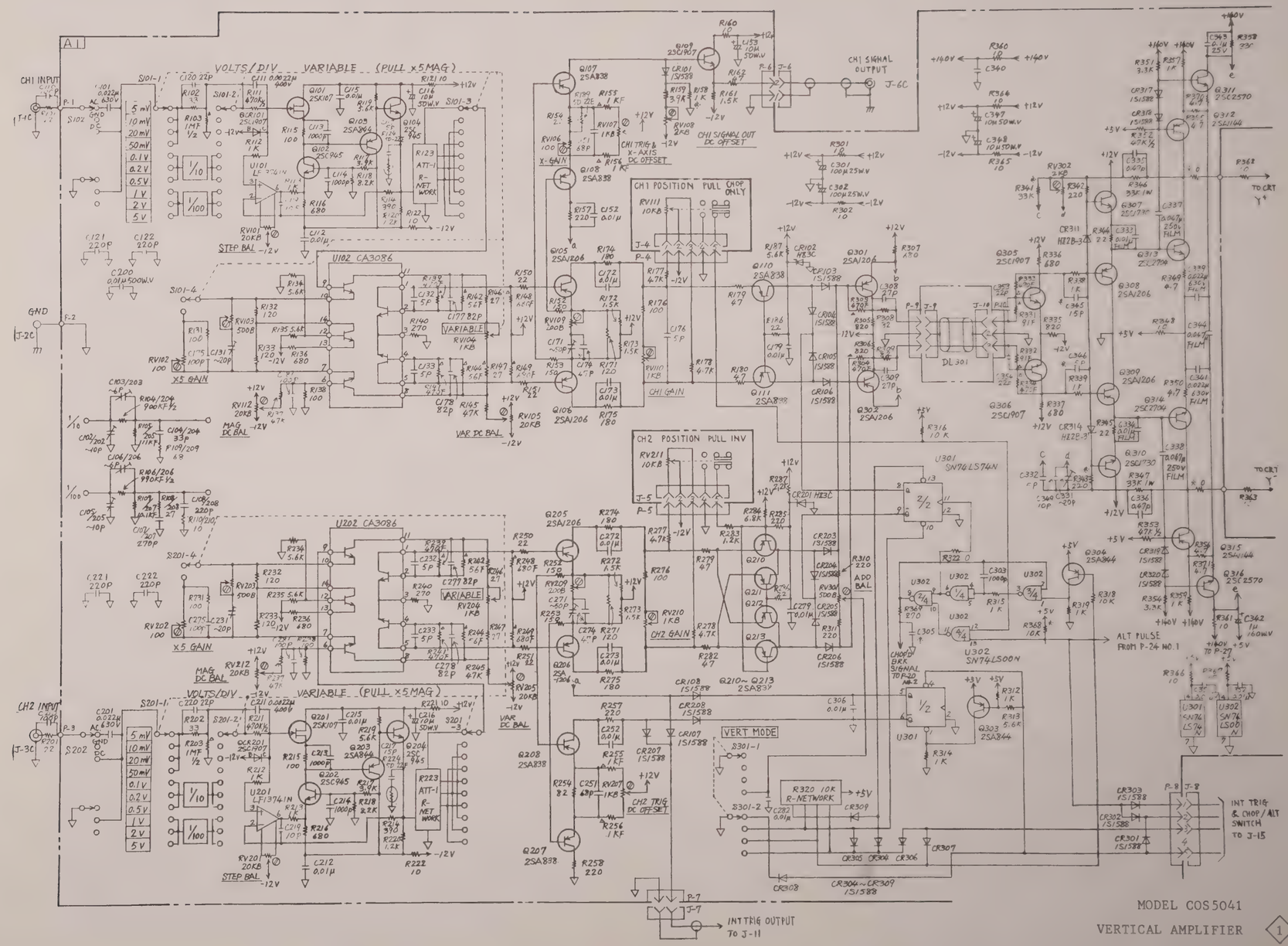


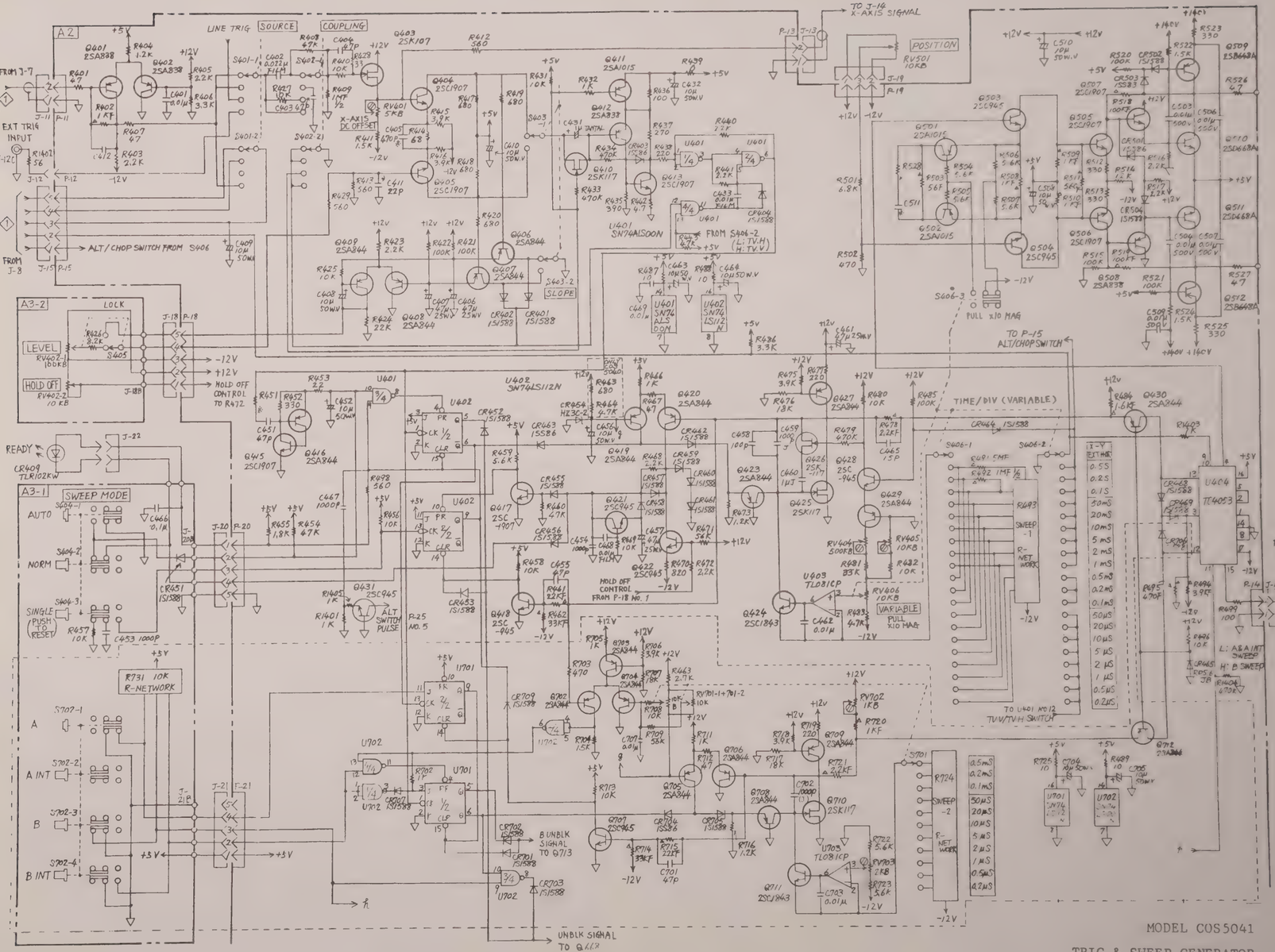

A2
A3-2
A3-1
LINE TRIG
SOURCE
COUPLING
EXT TRIG INPUT
ALT/CHOP SWITCH FROM S406
LOCK
LEVEL
HOLD OFF
HOLD OFF CONTROL TO R472
READY
CR409 TLR102KW
SWEEP MODE
AUTO
NORM
SINGLE PUSH TO RESET
A
A INT
B
B INT
X-AXIS DC OFFSET
SLOPE
ALT SWITCH PULSE
HOLD OFF CONTROL FROM P-18 NO.1
BUNBLK SIGNAL TO Q
UNBLK SIGNAL TO Q
TO J-14 X-AXIS SIGNAL
POSITION
RV501 10KB
FROM S406-2 (L:TV,V H:TV,H)
PULL x10 MAG
TO P-15 ALT/CHOP SWITCH
TIME/DIV (VARIABLE)
VARIABLE PULL x10 MAG
TO U401 NO.12 TV,V/TV,H SWITCH
L: A&A INT SWEEP
H: B SWEEP
FROM J-13
MODEL COS5040
TRIG & SWEEP GENERATOR
2

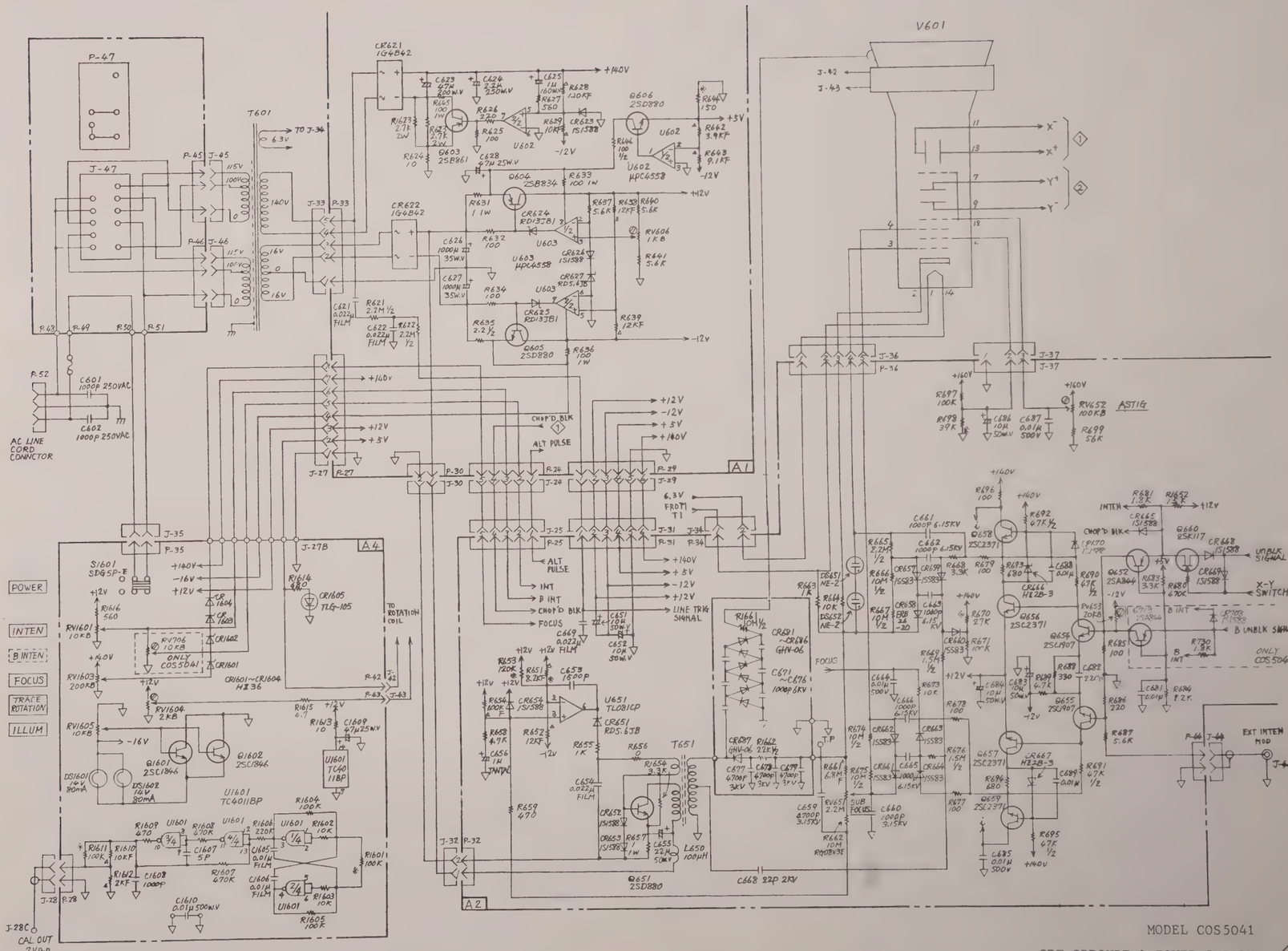


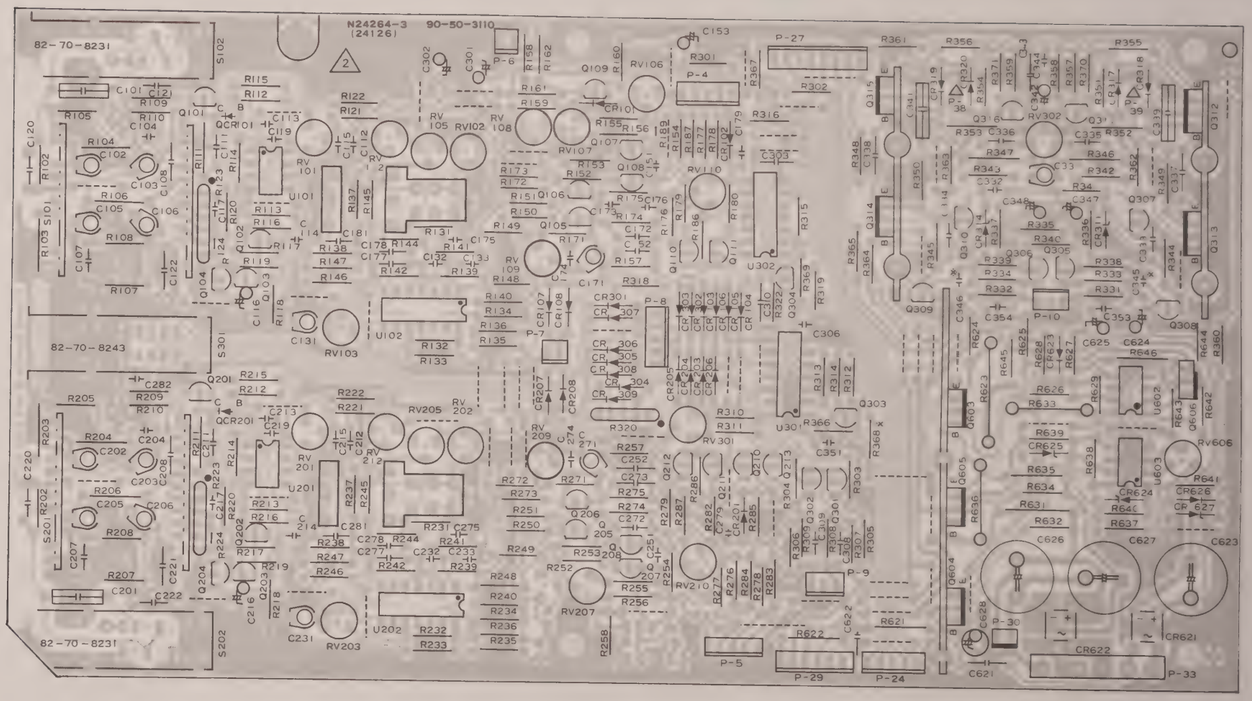
MODEL COS5040

CRT CIRCUIT & POWER SUPPLY

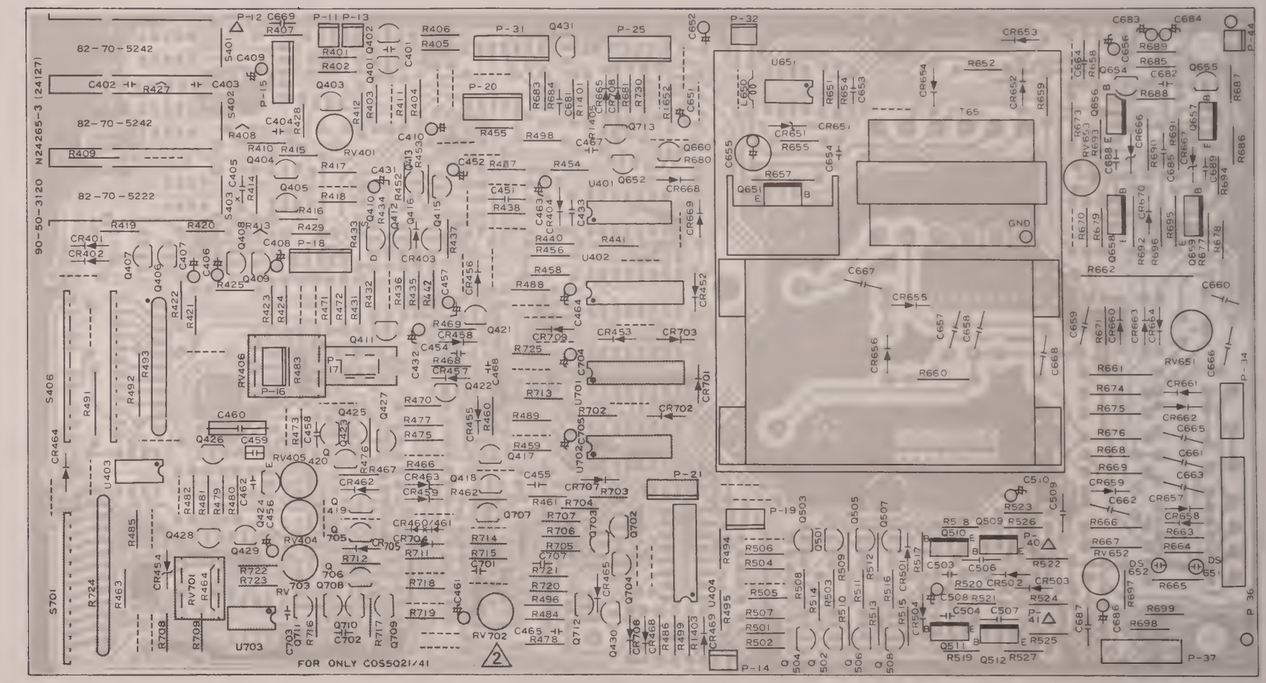

A1
CH1 INPUT
CH2 INPUT
GND
VOLTS/DIV VARIABLE (PULL x5 MAG)
5 mV
10 mV
20 mV
50 mV
0.1 V
0.2 V
0.5 V
1 V
2 V
5 V
STEP BAL
X5 GAIN
MAG DC BAL
VAR DC BAL
U102 CA3086
U202 CA3086
CH1 POSITION PULL CHOP ONLY
CH2 POSITION PULL INV
CH1 GAIN
CH2 GAIN
CH1 TRIG & X-AXIS DC OFFSET
CH2 TRIG DC OFFSET
CH1 SIGNAL OUTPUT
CH1 SIGNAL OUT DC OFFSET
ADD BAL
VERT MODE
R320 10K R-NETWORK
ALT PULSE FROM P-24 NO.1
CHOP'D BRK SIGNAL TO P-20
INT TRIG & CHOP/ALT SWITCH TO J-15
INT TRIG OUTPUT TO J-11
TO CRT Y+
TO CRT Y-
DL 301
U301 SN74LS74N
U302 SN74LS00N
CR304~CR309 1S1588
MODEL COS5041
VERTICAL AMPLIFIER
1


A2
A3-2
A3-1
LINE TRIG
SOURCE
COUPLING
EXT TRIG INPUT
ALT/CHOP SWITCH FROM S406
LOCK
LEVEL
HOLD OFF
READY
SWEEP MODE
AUTO
NORM
SINGLE (PUSH TO RESET)
R731 10K R-NETWORK
A
A INT
B
B INT
X-AXIS DC OFFSET
SLOPE
POSITION
TO J-16 X-AXIS SIGNAL
FROM S406-2 (L: TV-H H: TV-V)
PULL x10 MAG
TO P-15 ALT/CHOP SWITCH
TIME/DIV (VARIABLE)
SWEEP -1
SWEEP -2
R-NETWORK
VARIABLE
PULL x10 MAG
TO U401 NO.12 TV-V/TV-H SWITCH
HOLD OFF CONTROL FROM P-18 NO. 1
ALT SWITCH PULSE
B UNBLK SIGNAL TO Q713
UNBLK SIGNAL TO Q628
L: A&A INT SWEEP
H: B SWEEP
MODEL COS5041
TRIG & SWEEP GENERATOR
2


V601
T601
T651
P-47
J-47
P-45
J-45
P-46
J-46
P-63
P-49
P-50
P-51
P-52
AC LINE CORD CONNCTOR
C601 1000P 250VAC
C602 1000P 250VAC
TO 6.3V
TO J-34
115V
100V
140V
16V
CR622 1G4B42
CR621 1G4B42
C621 0.022μ FILM
C622 0.022μ FILM
R621 2.2M ½
R622 2.2M ½
J-33
P-33
J-27
P-27
+140V
+12V
+5V
-12V
-16V
CHOP'D BLK
ALT PULSE
INT
B INT
FOCUS
LINE TRIG SIGNAL
6.3V FROM T1
A1
A2
A4
J-30
P-30
J-24
P-24
J-29
P-29
J-25
P-25
J-31
P-31
J-34
P-34
J-35
P-35
J-27B
P-42
J-42
P-43
J-43
J-32
P-32
J-28
P-78
J-28C
CAL OUT 2Vp-p
POWER
INTEN
B INTEN
FOCUS
TRACE ROTATION
ILLUM
S1601 SDGSP-E
RV1601 10KB
RV1602 10KB
RV1603 200RB
RV1604 2KB
RV1605 10KB
RV1606 10KB
ONLY COS5041
CR1601~CR1604 M136
CR1605 TLG-105
TO ROTATION COIL
Q1601 2SC1846
Q1602 2SC1846
DS1601 14V 80mA
DS1602 14V 80mA
U1601 TC4011BP
U1601 TC601IBP
U651 TL081CP
Q603 2SB861
Q604 2SB834
Q605 2SD880
Q606 2SD880
U602 HPC4558
U603 HPC4558
Q651 2SD880
CR624 RD13TB1
CR625 RD13TB1
CR626 RD5.6JB
CR627 RD5.6JB
CR651 RD5.6JB
L650 100μH
J-36
P-36
J-37
RV652 100KB ASTIG
R699 56K
C686 10μ 50WV
C687 0.01μ 500V
Q658 2SC2371
Q656 2SC2371
Q655 2SC4907
Q657 2SC2371
Q659 2SC2371
Q652 2SA1244
Q654 2SA1244
Q660 2SK117
CR665 1S1588
CR666 HZ2B-3
CR667 HZ3B-3
UNBLK SIGNAL
X-Y SWITCH
B UNBLK SIGNAL
EXT INTEN MOD
J-44
P-44
J-44C
SUB FOCUS
C668 22P 2KV
MODEL COS5041
CRT CIRCUIT & POWER SUPPLY
3

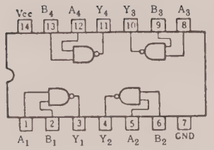


Vert Amp & Power Supply Al Parts Location Diagram (Parts Side View)

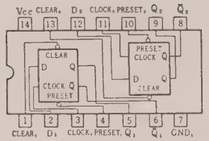


Sweep & H.V. A2 Parts Location Diagram (Parts Side View)

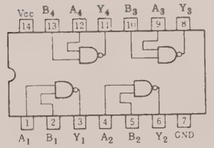
DIGITAL & ANALOG ICs



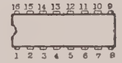
(TOP VIEW)
TC4011BP



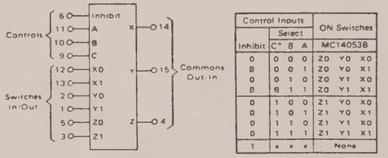
(TOP VIEW)
SN74LS74N



(TOP VIEW)
SN74LS00N
SN74ALS00N

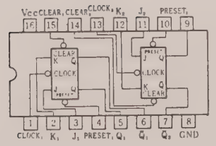


(TOP VIEW)

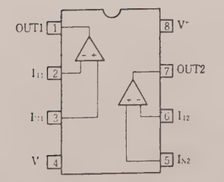


Control Inputs				ON Switches
	Select			
Inhibit	C*	B	A	MC14053B
0	0	0	0	Z0 Y0 X0
0	0	0	1	Z0 Y0 X1
0	0	1	0	Z0 Y1 X0
0	0	1	1	Z0 Y1 X1
0	1	0	0	Z1 Y0 X0
0	1	0	1	Z1 Y0 X1
0	1	1	0	Z1 Y1 X0
0	1	1	1	Z1 Y1 X1
1	*	*	*	None

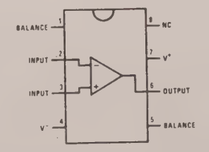
TC4053BP



(TOP VIEW)
SN74LS112N

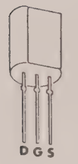


(TOP VIEW)
μPC4558C



(TOP VIEW)
LF13741N
TL081CP

FET

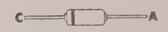


2SK107-3
2SK117-BL

DIODE

GHV-06SSN
ERB26-20

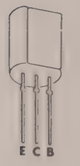
1S1588



1SS83 HZ2B RD5.6JB
1SS86 HZ3C RD13JB
HZ36L

1G4B42

TRANSISTOR

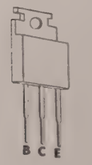


2SA844-D
2SC1907

2SC2570

2SA1144-O
2SB648A
2SC1846-R
2SC2371-L
2SC2704-O
2SD668A

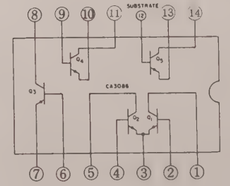
2SA1206-L



2SB834-Y
2SB861-C
2SD880-Y

2SA838-B
2SA1015-Y
2SC945-Y
2SC1730-L
2SC1843-E

TRANSISTOR ARRAY



(TOP VIEW)
CA3086

LED

TLG-105

TLR102KW

SEMICONDUCTOR LEAD CONFIGURATION

REPLACEABLE PARTS
FOR COS5040

ABBREVIATIONS

CER:	CERAMIC
C FILM:	CARBON FILM
C COMP:	CARBON COMPOSITION
CRT:	CATHODE RAY TUBE
ELECT:	ELECTROLYTIC
FET:	FIELD EFFECT TRANSISTOR
FXD:	FIXED
LED:	LIGHT EMITTING DIODE
M FILM:	METAL FILM
M GLAZE:	METAL GLAZE
M OX:	METAL OXIDE
M PLSTC FILM:	METALLIZED PLASTIC FILM
PLSTC FILM:	PLASTIC FILM
Si:	SILICON
TANT ELECT:	TANTALUM ELECTROLYTIC
VAR:	VARIABLE
WW:	WIREWOUND
*:	OPTIMUM VALUE SELECTED AT FACTORY. AVERAGE VALUE SHOWN.(PART MAY BE OMITTED.)

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	
A1	ASSEMBLY		
CR101	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR102	32-92-0033	ZENER VZ=3.2-3.4V	HITACHI HZ3C-2
CR103	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR104	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR105	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR106	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR107	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR108	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR201	32-92-0033	ZENER VZ=3.2-3.4V	HITACHI HZ3C-2
CR203	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR204	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR205	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR206	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR207	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR208	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR301	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR302	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR303	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR304	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR305	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR306	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR307	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR308	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR309	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR311	32-92-0022	ZENER VZ=2.1-2.3V	HITACHI HZ2B-3
CR314	32-92-0022	ZENER VZ=2.1-2.3V	HITACHI HZ2B-3
CR317	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR318	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR319	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR320	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR621	32-90-2110	DIODE BRIDGE VRM=400V IO=1A	TOSHIBA 1G4B42
CR622	32-90-2110	DIODE BRIDGE VRM=400V IO=1A	TOSHIBA 1G4B42
CR623	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR624	32-92-0130	ZENER VZ=12.41-13.05V P=0.4W	NEC RD13J
CR625	32-92-0130	ZENER VZ=12.41-13.05V P=0.4W	NEC RD13J
CR626	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR627	32-92-0056	ZENER VZ=5.5-5.8V P=0.4W	NEC RD6.8J
Q101	31-20-1073	FET	SONY 2SK107-3
Q102	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q103	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q104	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q105	30-11-2061	TR SI PNP	NEC 2SA1206-L
Q106	30-11-2061	TR SI PNP	NEC 2SA1206-L
Q107	30-10-8381	TR SI PNP	MATSUSHITA 2SA838-B
Q108	30-10-8381	TR SI PNP	MATSUSHITA 2SA838-B
Q109	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q110	30-10-8381	TR SI PNP	MATSUSHITA 2SA838-B
Q111	30-10-8381	TR SI PNP	MATSUSHITA 2SA838-B
Q201	31-20-1073	FET	SONY 2SK107-3
Q202	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q203	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q204	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q205	30-11-2061	TR SI PNP	NEC 2SA1206-L
Q206	30-11-2061	TR SI PNP	NEC 2SA1206-L
Q207	30-10-8381	TR SI PNP	MATSUSHITA 2SA838-B
Q208	30-10-8381	TR SI PNP	MATSUSHITA 2SA838-B
Q210	30-10-8381	TR SI PNP	MATSUSHITA 2SA838-B
Q211	30-10-8381	TR SI PNP	MATSUSHITA 2SA838-B
Q212	30-10-8381	TR SI PNP	MATSUSHITA 2SA838-B
Q213	30-10-8381	TR SI PNP	MATSUSHITA 2SA838-B
Q301	30-11-2061	TR SI PNP	NEC 2SA1206-L
Q302	30-11-2061	TR SI PNP	NEC 2SA1206-L
Q303	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q304	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q305	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q306	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q307	30-31-7301	TR SI NPN	NEC 2SC1730-L
Q308	30-11-2061	TR SI PNP	NEC 2SA1206-L
Q309	30-11-2061	TR SI PNP	NEC 2SA1206-L
Q310	30-31-7301	TR SI NPN	NEC 2SC1730-L
Q311	30-32-5700	TR SI NPN	NEC 2SC2570
Q312	30-11-1441	TR SI PNP	TOSHIBA 2SA1144-O
Q313	30-32-7041	TR SI NPN	TOSHIBA 2SC2704-O
Q314	30-32-7041	TR SI NPN	TOSHIBA 2SC2704-O
Q315	30-11-1441	TR SI PNP	TOSHIBA 2SA1144-O

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	
Q316	30-32-5700	TR SI NPN	NEC 2SC2570
Q603	30-20-8611	TR SI PNP	HITACHI 2SB861-C
Q604	30-20-8341	TR SI PNP	TOSHIBA 2SB834-Y
Q605	30-40-8802	TR SI NPN	NEC 2SD880-Y
Q606	30-40-8802	TR SI NPN	NEC 2SD880-Y
QCR101	30-31-9071	TR SI NPN	HITACHI 2SC1907
QCR201	30-31-9071	TR SI NPN	HITACHI 2SC1907
U101	34-00-0121	FET OPEAMP	N.S LF13741N
U102	30-90-0141	TRANSISTOR ARRAYS 5 NPN	RCA CA3086
U201	34-00-0121	FET OPEAMP	N.S LF13741N
U202	30-90-0141	TRANSISTOR ARRAYS 5 NPN	RCA CA3086
U301	35-70-0741	DUAL D-FLIP FLOP	T.I SN74LS74N
U302	35-70-0001	QUAD 2-INPUT POSI-NAND	T.I SN74LS00N
U602	34-00-0240	DUAL OPEAMP	NEC UPC4558C
U603	34-00-0240	DUAL OPEAMP	NEC UPC4558C
R102	40-27-0332	FXD C FILM 33 OHM 5% 1/4W	
R103	42-74-5100	FXD M FILM 1M OHM 1% 1/2W	
R104	42-74-4900	FXD M FILM 900K OHM 1% 1/2W	
R105	42-72-4111	FXD M FILM 111K OHM 1% 1/4W	
R106	42-74-4990	FXD M FILM 990K OHM 1% 1/2W	
R107	42-72-3101	FXD M FILM 10.1K OHM 1% 1/4W	
R108	40-27-0222	FXD C FILM 22 OHM 5% 1/4W	
R109	40-27-0682	FXD C FILM 68 OHM 5% 1/4W	
R110	40-27-0102	FXD C FILM 10 OHM 5% 1/4W	
R111	40-37-4471	FXD C FILM 470K OHM 5% 1/2W	
R112	40-27-2102	FXD C FILM 1K OHM 5% 1/4W	
R113	40-27-2102	FXD C FILM 1K OHM 5% 1/4W	
R114	40-27-1392	FXD C FILM 390 OHM 5% 1/4W	
R115	40-27-1102	FXD C FILM 100 OHM 5% 1/4W	
R116	40-27-1682	FXD C FILM 680 OHM 5% 1/4W	
R117	40-27-2392	FXD C FILM 3.9K OHM 5% 1/4W	
R118	40-27-2822	FXD C FILM 8.2K OHM 5% 1/4W	
R119	40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W	
R120	40-27-2122	FXD C FILM 1.2K OHM 5% 1/4W	
R121	40-27-0102	FXD C FILM 10 OHM 5% 1/4W	
R122	40-27-0102	FXD C FILM 10 OHM 5% 1/4W	
R123	44-04-0000	FXD M GLAZE R-NETWORK	KIKUSUI S8109001
R124	38-00-0000	THERMISTER 250 OHM	
R131	40-27-1102	FXD C FILM 100 OHM 5% 1/4W	
R132	40-27-1122	FXD C FILM 120 OHM 5% 1/4W	
R133	40-27-1122	FXD C FILM 120 OHM 5% 1/4W	
R134	40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W	
R135	40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W	
R136	40-27-1682	FXD C FILM 680 OHM 5% 1/4W	
R137	40-27-3472	FXD C FILM 47K OHM 5% 1/4W	
R138	40-27-1102	FXD C FILM 100 OHM 5% 1/4W	
R139	42-72-1470	FXD M FILM 470 OHM 1% 1/4W	
R140	40-27-1272	FXD C FILM 270 OHM 5% 1/4W	
R141	42-72-1470	FXD M FILM 470 OHM 1% 1/4W	
R142	42-72-0560	FXD M FILM 56 OHM 1% 1/4W	
R144	42-72-0560	FXD M FILM 56 OHM 1% 1/4W	
R145	40-27-3472	FXD C FILM 47K OHM 5% 1/4W	
R146	40-27-0272	FXD C FILM 27 OHM 5% 1/4W	
R147	40-27-0272	FXD C FILM 27 OHM 5% 1/4W	
R148	42-72-1680	FXD M FILM 680 OHM 1% 1/4W	
R149	42-72-1680	FXD M FILM 680 OHM 1% 1/4W	
R150	40-27-0222	FXD C FILM 22 OHM 5% 1/4W	
R151	40-27-0222	FXD C FILM 22 OHM 5% 1/4W	
R152	40-27-1152	FXD C FILM 150 OHM 5% 1/4W	
R153	40-27-1152	FXD C FILM 150 OHM 5% 1/4W	
R154	40-27-0222	FXD C FILM 22 OHM 5% 1/4W	
R155	42-72-2100	FXD M FILM 1K OHM 1% 1/4W	
R156	42-72-2100	FXD M FILM 1K OHM 1% 1/4W	
R157	40-27-1222	FXD C FILM 220 OHM 5% 1/4W	
R158 ※	40-27-2102	FXD C FILM 1K OHM 5% 1/4W	
R159	40-27-2392	FXD C FILM 3.9K OHM 5% 1/4W	
R160	40-27-0102	FXD C FILM 10 OHM 5% 1/4W	
R161	40-27-2152	FXD C FILM 1.5K OHM 5% 1/4W	
R162	40-27-0472	FXD C FILM 47 OHM 5% 1/4W	
R171	40-27-1122	FXD C FILM 120 OHM 5% 1/4W	
R172	40-27-2152	FXD C FILM 1.5K OHM 5% 1/4W	
R173	40-27-2152	FXD C FILM 1.5K OHM 5% 1/4W	
R174	40-27-1182	FXD C FILM 180 OHM 5% 1/4W	
R175	40-27-1182	FXD C FILM 180 OHM 5% 1/4W	

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	
R176	40-27-1272	FXD C FILM	270 OHM 5% 1/4W
R177	40-27-2472	FXD C FILM	4.7K OHM 5% 1/4W
R178	40-27-2472	FXD C FILM	4.7K OHM 5% 1/4W
R179	40-27-0472	FXD C FILM	47 OHM 5% 1/4W
R180	40-27-0472	FXD C FILM	47 OHM 5% 1/4W
R181	40-27-0222	FXD C FILM	22 OHM 5% 1/4W
R182	40-27-2562	FXD C FILM	5.6K OHM 5% 1/4W
R183	38-00-0000	THERMISTER	250 OHM
R184	40-27-0332	FXD C FILM	33 OHM 5% 1/4W
R185	42-74-5100	FXD M FILM	1M OHM 1% 1/2W
R186	42-74-4900	FXD M FILM	900K OHM 1% 1/2W
R205	42-72-4111	FXD M FILM	111K OHM 1% 1/4W
R206	42-74-4990	FXD M FILM	990K OHM 1% 1/2W
R207	42-72-3101	FXD M FILM	10.1K OHM 1% 1/4W
R208	40-27-0222	FXD C FILM	22 OHM 5% 1/4W
R209	40-27-0680	FXD C FILM	68 OHM 5% 1/4W
R210	40-27-0102	FXD C FILM	10 OHM 5% 1/4W
R211	40-27-4471	FXD C FILM	470K OHM 5% 1/2W
R212	40-27-2102	FXD C FILM	1K OHM 5% 1/4W
R213	40-27-2102	FXD C FILM	1K OHM 5% 1/4W
R214	40-27-1392	FXD C FILM	390 OHM 5% 1/4W
R215	40-27-1102	FXD C FILM	100 OHM 5% 1/4W
R216	40-27-1682	FXD C FILM	680 OHM 5% 1/4W
R217	40-27-2392	FXD C FILM	3.9K OHM 5% 1/4W
R218	40-27-2822	FXD C FILM	8.2K OHM 5% 1/4W
R219	40-27-2562	FXD C FILM	5.6K OHM 5% 1/4W
R220	40-27-2122	FXD C FILM	1.2K OHM 5% 1/4W
R221	40-27-0102	FXD C FILM	10 OHM 5% 1/4W
R222	40-27-0102	FXD C FILM	10 OHM 5% 1/4W
R223	44-04-0006	FXD M GLAZE	R-NETWORK KIKUSUI S8109001
R224	38-00-0000	THERMISTER	250 OHM
R231	40-27-1102	FXD C FILM	100 OHM 5% 1/4W
R232	40-27-1122	FXD C FILM	120 OHM 5% 1/4W
R233	40-27-1122	FXD C FILM	120 OHM 5% 1/4W
R234	40-27-2562	FXD C FILM	5.6K OHM 5% 1/4W
R235	40-27-2562	FXD C FILM	5.6K OHM 5% 1/4W
R236	40-27-1682	FXD C FILM	680 OHM 5% 1/4W
R237	40-27-3472	FXD C FILM	47K OHM 5% 1/4W
R238	40-27-1102	FXD C FILM	100 OHM 5% 1/4W
R239	42-72-1470	FXD M FILM	470 OHM 1% 1/4W
R240	40-27-1272	FXD C FILM	270 OHM 5% 1/4W
R241	42-72-1470	FXD M FILM	470 OHM 1% 1/4W
R242	42-72-0560	FXD M FILM	56 OHM 1% 1/4W
R244	42-72-0560	FXD M FILM	56 OHM 1% 1/4W
R245	40-27-3472	FXD C FILM	47K OHM 5% 1/4W
R246	40-27-0272	FXD C FILM	27 OHM 5% 1/4W
R247	40-27-0272	FXD C FILM	27 OHM 5% 1/4W
R248	42-72-1680	FXD M FILM	680 OHM 1% 1/4W
R249	42-72-1680	FXD M FILM	680 OHM 1% 1/4W
R250	40-27-0222	FXD C FILM	22 OHM 5% 1/4W
R251	40-27-0222	FXD C FILM	22 OHM 5% 1/4W
R252	40-27-1152	FXD C FILM	150 OHM 5% 1/4W
R253	40-27-1152	FXD C FILM	150 OHM 5% 1/4W
R254	40-27-0822	FXD C FILM	82 OHM 5% 1/4W
R255	42-72-2100	FXD M FILM	1K OHM 1% 1/4W
R256	42-72-2100	FXD M FILM	1K OHM 1% 1/4W
R257	40-27-1222	FXD C FILM	220 OHM 5% 1/4W
R258	40-27-1222	FXD C FILM	220 OHM 5% 1/4W
R271	40-27-1122	FXD C FILM	120 OHM 5% 1/4W
R272	40-27-2152	FXD C FILM	1.5K OHM 5% 1/4W
R273	40-27-3152	FXD C FILM	1.5K OHM 5% 1/4W
R274	40-27-1182	FXD C FILM	180 OHM 5% 1/4W
R275	40-27-1182	FXD C FILM	180 OHM 5% 1/4W
R276	40-27-1272	FXD C FILM	270 OHM 5% 1/4W
R277	40-27-2472	FXD C FILM	4.7K OHM 5% 1/4W
R278	40-27-2472	FXD C FILM	4.7K OHM 5% 1/4W
R279	40-27-0472	FXD C FILM	47 OHM 5% 1/4W
R280	40-27-0472	FXD C FILM	47 OHM 5% 1/4W
R283	40-27-2122	FXD C FILM	1.2K OHM 5% 1/4W
R284	40-27-2682	FXD C FILM	6.8K OHM 5% 1/4W
R285	40-27-1222	FXD C FILM	220 OHM 5% 1/4W
R286	40-27-0222	FXD C FILM	22 OHM 5% 1/4W
R287	40-27-2322	FXD C FILM	3.2K OHM 5% 1/4W
R301	40-27-0102	FXD C FILM	10 OHM 5% 1/4W
R302	40-27-0102	FXD C FILM	10 OHM 5% 1/4W
R303	42-72-1470	FXD M FILM	470 OHM 1% 1/4W
R304	42-72-1470	FXD M FILM	470 OHM 1% 1/4W

REFERENCE DESIGNATOR		KIKUSUI PARTS NO.	DESCRIPTION
R305		40-27-1822	FXD C FILM 820 OHM 5% 1/4W
R306		40-27-1822	FXD C FILM 820 OHM 5% 1/4W
R307		40-27-1682	FXD C FILM 680 OHM 5% 1/4W
R308		40-27-0822	FXD C FILM 82 OHM 5% 1/4W
R309		40-27-0822	FXD C FILM 82 OHM 5% 1/4W
R310		40-27-1222	FXD C FILM 220 OHM 5% 1/4W
R311		40-27-1222	FXD C FILM 220 OHM 5% 1/4W
R312		40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R313		40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W
R314		40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R315		40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R316		40-27-3102	FXD C FILM 10K OHM 5% 1/4W
R318		40-27-3102	FXD C FILM 10K OHM 5% 1/4W
R319		40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R320		44-07-0020	FXD M GLAZE RESISTOR NETWORKS 10K OHM X4
R331		42-72-0910	FXD M FILM 91 OHM 1% 1/4W
R332		42-72-0910	FXD M FILM 91 OHM 1% 1/4W
R333		42-72-1470	FXD M FILM 470 OHM 1% 1/4W
R334		42-72-1470	FXD M FILM 470 OHM 1% 1/4W
R335		40-27-1822	FXD C FILM 820 OHM 5% 1/4W
R336		40-27-1682	FXD C FILM 680 OHM 5% 1/4W
R337		40-27-1682	FXD C FILM 680 OHM 5% 1/4W
R338		40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R339		40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R341	*	40-27-3332	FXD C FILM 33K OHM 5% 1/4W
R342		40-27-1222	FXD C FILM 220 OHM 5% 1/4W
R343		40-27-1222	FXD C FILM 220 OHM 5% 1/4W
R344		40-27-0222	FXD C FILM 22 OHM 5% 1/4W
R345		40-27-0222	FXD C FILM 22 OHM 5% 1/4W
R346		44-91-3330	FXD M OXIDE 33K OHM 5% 1W
R347		44-91-3330	FXD M OXIDE 33K OHM 5% 1W
R348		40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R349		40-27-8472	FXD C FILM 4.7 OHM 5% 1/4W
R350		40-27-8472	FXD C FILM 4.7 OHM 5% 1/4W
R351		40-27-2332	FXD C FILM 3.3K OHM 5% 1/4W
R352		40-37-3471	FXD C FILM 47K OHM 5% 1/2W
R353		40-37-3471	FXD C FILM 47K OHM 5% 1/2W
R354		40-27-2332	FXD C FILM 3.3K OHM 5% 1/4W
R355		40-27-8472	FXD C FILM 4.7 OHM 5% 1/4W
R356		40-27-8472	FXD C FILM 4.7 OHM 5% 1/4W
R357		40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R358		40-27-1332	FXD C FILM 330 OHM 5% 1/4W
R359		40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R360		40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R361		40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R362		40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R363		40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R364		40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R365		40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R366		40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R367		40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R368	*	40-27-3102	FXD C FILM 10K OHM 5% 1/4W
R369		40-27-1272	FXD C FILM 270 OHM 5% 1/4W
R370		40-27-8472	FXD C FILM 4.7 OHM 5% 1/4W
R371		40-27-8472	FXD C FILM 4.7 OHM 5% 1/4W
R621		40-37-5221	FXD C FILM 2.2M OHM 5% 1/2W
R622		40-37-5221	FXD C FILM 2.2M OHM 5% 1/2W
R623		44-92-2270	FXD M OXIDE 2.7K OHM 5% 2W
R624		40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R625		40-27-1102	FXD C FILM 100 OHM 5% 1/4W
R626		40-27-1222	FXD C FILM 220 OHM 5% 1/4W
R627		40-27-1562	FXD C FILM 560 OHM 5% 1/4W
R628		42-72-4120	FXD M FILM 120K OHM 1% 1/4W
R629		42-72-3100	FXD M FILM 10K OHM 1% 1/4W
R631		44-91-0010	FXD M OXIDE 1 OHM 5% 1W
R632		40-27-1102	FXD C FILM 100 OHM 5% 1/4W
R633		44-91-1100	FXD M OXIDE 100 OHM 5% 1W
R634		40-27-1102	FXD C FILM 100 OHM 5% 1/4W
R635		40-37-8222	FXD C FILM 2.2 OHM 5% 1/2W
R636		44-91-1100	FXD M OXIDE 100 OHM 5% 1W
R637		40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W
R638		42-72-3120	FXD M FILM 12K OHM 1% 1/4W
R639		42-72-3120	FXD M FILM 12K OHM 1% 1/4W
R640		40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W
R641		40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W
R642		42-72-2390	FXD M FILM 3.9K OHM 1% 1/4W
R643		42-72-2910	FXD M FILM 9.1K OHM 1% 1/4W

REFERENCE DESIGNATION	KTKUSUI PARTS NO.	DESCRIPTION
R444 *	40-27-1152	FXD C FILM 150 OHM 5% 1/4W
R47[illegible]	44-21-1100	FXD M OXIDE 100 OHM 5% 1W
R447	40-37-1101	FXD C FILM 100 OHM 5% 1/2W
R[illegible]74	44-23-2270	FXD M OXIDE 2.7K OHM 5% 2W
RV101	48-33-3200	VAR M FILM 20K OHM
RV102	48-33-1100	VAR M FILM 100 OHM
RV103	48-33-1500	VAR M FILM 500 OHM
RV105	48-33-3200	VAR M FILM 20K OHM
RV106	48-33-1100	VAR M FILM 100 OHM
RV107	48-33-2100	VAR M FILM 1K OHM
RV108	48-33-2200	VAR M FILM 2K OHM
RV109	48-33-1200	VAR M FILM 200 OHM
RV110	48-33-2100	VAR M FILM 1K OHM
RV111	48-33-3200	VAR M FILM 20K OHM
RV201	48-33-3200	VAR M FILM 20K OHM
RV202	48-33-1100	VAR M FILM 100 OHM
RV203	48-33-1500	VAR M FILM 500 OHM
RV205	48-33-3200	VAR M FILM 20K OHM
RV207	48-33-2100	VAR M FILM 1K OHM
RV209	48-33-1200	VAR M FILM 200 OHM
RV210	48-33-2100	VAR M FILM 1K OHM
RV211	48-33-3200	VAR M FILM 20K OHM
RV401	48-33-1500	VAR M FILM 500 OHM
RV402	48-33-2200	VAR M FILM 2K OHM
RV404	48-33-2100	VAR M FILM 1K OHM
C101	50-96-3590	FXD PLSTC FILM 0.022UF 20% 630V
C102	57-10-1191	VAR CER 3-10PF
C103	57-10-1181	VAR CER 3-6PF
C104	52-06-3165	FXD CER 33PF 10% 500V TYPE1
C105	57-10-1191	VAR CER 3-10PF
C106	57-10-1181	VAR CER 3-6PF
C107	52-06-2225	FXD CER 220PF 10% 50V TYPE1
C108	52-06-2225	FXD CER 220PF 10% 50V TYPE1
C111	50-87-0510	FXD PLSTC FILM 2200PF 10% 400V
C112	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2
C113	52-01-3345	FXD CER 1000PF 10% 500V TYPE2
C114	52-01-3345	FXD CER 1000PF 10% 500V TYPE2
C115	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2
C116	54-00-0311	FXD ELECT 10UF 50V
C117	52-06-3125	FXD CER 15PF 10% 500V TYPE1
C119	52-06-3102	FXD CER 10PF 10% 500V TYPE1
C120	52-06-3145	FXD CER 22PF 10% 500V TYPE1
C121	52-06-2265	FXD CER 220PF 10% 50V TYPE1
C122	52-06-2265	FXD CER 220PF 10% 50V TYPE1
C131	57-10-1203	VAR CER 5-20PF
C132	52-06-3051	FXD CER 5PF 10% 500V TYPE1
C133	52-06-3051	FXD CER 5PF 10% 500V TYPE1
C151	52-06-2204	FXD CER 68P 10% 50V TYPE1
C152	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2
C153	54-00-0311	FXD ELECT 10UF 50V
C171	57-10-1223	VAR CER 8-50PF
C172	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2
C173	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2
C174	52-06-3165	FXD CER 33PF 10% 500V TYPE1
C175	52-06-2225	FXD CER 100PF 10% 50V TYPE1
C176	52-06-3051	FXD CER 5PF 10% 500V TYPE1
C177	52-06-2215	FXD CER 82PF 10% 500V TYPE1
C178	52-06-2215	FXD CER 82PF 10% 500V TYPE1
C179	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2
C181	52-06-2225	FXD CER 100PF 10% 50V TYPE1
C200	52-03-3469	FXD CER 0.01UF +100-0% 500V TYPE2
C201	50-96-3590	FXD PLSTC FILM 0.022UF 20% 630V
C202	57-10-1191	VAR CER 3-10PF
C203	57-10-1181	VAR CER 3-6PF
C204	52-06-3165	FXD CER 33PF 10% 500V TYPE1
C205	57-10-1191	VAR CER 3-10PF
C206	57-10-1181	VAR CER 3-6PF
C207	52-06-2265	FXD CER 220PF 10% 50V TYPE1
C208	52-06-2265	FXD CER 220PF 10% 50V TYPE1
C211	50-87-0510	FXD PLSTC FILM 2200PF 10% 400V
C212	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2
C213	52-01-3345	FXD CER 1000PF 10% 500V TYPE2
C214	52-01-3345	FXD CER 1000PF 10% 500V TYPE2
C215	52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2
C216	54-00-0311	FXD ELECT 10UF 50V

REFERENCE DESIGNATOR		KIKUSUI PARTS NO.	DESCRIPTION	
C217		52-06-3125	FXD CER 15PF 10% 500V TYPE1	
C219		52-06-3102	FXD CER 10PF 10% 500V TYPE1	
C220		52-06-3145	FXD CER 22PF 10% 500V TYPE1	
C221		52-06-2265	FXD CER 220PF 10% 50V TYPE1	
C222		52-06-2265	FXD CER 220PF 10% 50V TYPE1	
C231		57-10-1203	VAR CER 5-20PF	
C232		52-06-3051	FXD CER 5PF 10% 500V TYPE1	
C233		52-06-3051	FXD CER 5PF 10% 500V TYPE1	
C251		52-06-2204	FXD CER 68P 10% 50V TYPE1	
C252		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C271		57-10-1223	VAR CER 8-50PF	
C272		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C273		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C274		52-06-3165	FXD CER 33PF 10% 500V TYPE1	
C275		52-06-2225	FXD CER 100PF 10% 50V TYPE1	
C277		52-06-2215	FXD CER 82PF 10% 500V TYPE1	
C278		52-06-2215	FXD CER 82PF 10% 500V TYPE1	
C279		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C281		52-06-2225	FXD CER 100PF 10% 50V TYPE1	
C282		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C301		54-00-0121	FXD ELECT 100UF 25V	
C302		54-00-0121	FXD ELECT 100UF 25V	
C303		52-01-3345	FXD CER 1000PF 10% 500V TYPE2	
C305		—	—	
C306		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C308		52-06-3155	FXD CER 27PF 10% 500V TYPE1	
C309		52-06-3155	FXD CER 27PF 10% 500V TYPE1	
C331		57-10-1203	VAR CER 5-20PF	
C332		52-06-3051	FXD CER 5PF 10% 500V TYPE1	
C333		50-45-0500	FXD PLSTC FILM 0.01MF 5% 50V	
C334		50-45-0500	FXD PLSTC FILM 0.01MF 5% 50V	
C335		52-96-1140	FXD COMP 0.47PF 10% 500V	
C336		52-96-1140	FXD COMP 0.47PF 10% 500V	
C337		50-77-3500	FXD PLSTC FILM 0.047UF 20% 250V	
C338		50-77-3500	FXD PLSTC FILM 0.047UF 20% 250V	
C339		50-96-3590	FXD PLSTC FILM 0.022UF 20% 630V	
C341		50-96-3590	FXD PLSTC FILM 0.022UF 20% 630V	
C342		54-60-1550	FXD ELECT 1UF 160V	
C343		52-05-1498	FXD CER 0.1UF +80-20% 25V TYPE2	
C344		50-67-0050	FXD PLSTC FILM 0.047UF 10% 100V	
C345	※	52-06-3125	FXD CER 15PF 10% 500V TYPE1	
C346	※	52-06-3125	FXD CER 15PF 10% 500V TYPE1	
C347		54-00-0311	FXD ELECT 10UF 50V	
C348		54-00-0311	FXD ELECT 10UF 50V	
C349		52-06-3102	FXD CER 10PF 10% 500V TYPE1	
C351		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C352		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C353		52-06-3145	FXD CER 22PF 10% 500V TYPE1	
C354		52-06-3145	FXD CER 22PF 10% 500V TYPE1	
C621		50-67-0040	FXD PLSTC FILM 0.022UF 10% 100V	
C622		50-67-0040	FXD PLSTC FILM 0.022UF 10% 100V	
C623		54-60-1620	FXD ELECT 47UF 200V	
C624		54-70-1020	FXD ELECT 2.2UF 250V	
C625		54-60-1550	FXD ELECT 1UF 160V	
C626		54-00-0231	FXD ELECT 1000UF 35V	
C627		54-00-0231	FXD ELECT 1000UF 35V	
C628		54-00-0114	FXD ELECT 47UF 25V	
S101		80-98-0580	SW ROTARY WITH RV VOLT/DIV	ALPS S21P2YC
S102		82-70-8231	LEVER SWITCH	ALPS SLR823-1
S201		80-98-0580	SW ROTARY WITH RV VOLT/DIV	ALPS S21P2YC
S202		82-70-8231	LEVER SWITCH	ALPS SLR823-1
S301		82-70-8243	LEVER SWITCH	ALPS SLR824-3
A2 ASSEMBLY				
CR401		32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR402		32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR403		32-30-0860	DIODE VR=30V IO=30MA	HITACHI 1S536
CR404		32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR452		32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR453		32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR454		32-92-0033	ZENER VZ=3.2-3.4V	HITACHI HZ3C-2
CR455		32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR456		32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR457		32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR458		32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR459		32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	
CR[illegible]	[illegible]	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR[illegible]	[illegible]	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR[illegible]	[illegible]	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR[illegible]	[illegible]	DIODE VR=30V IO=30MA	HITACHI 1SS86
CR[illegible]	[illegible]	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR[illegible]	[illegible]	ZENER VZ=5.0-5.8V P=0.4W	NEC RD5.6J
CR[illegible]	[illegible]	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR[illegible]	[illegible]	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR[illegible]	[illegible]	DIODE VR=30V IO=30MA	HITACHI 1SS86
CR[illegible]	[illegible]	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR[illegible]	[illegible]	DIODE VR=250V IO=200MA	HITACHI 1SS83
CR[illegible]	[illegible]	ZENER VZ=5.5-6.8V P=0.4W	NEC RD5.6J
CR[illegible]	[illegible]	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR[illegible]	[illegible]	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR[illegible]	[illegible]	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR[illegible]	[illegible]	DIODE VR=250V IO=200MA	HITACHI 1SS83
CR[illegible]	[illegible]	DIODE VR=2KV FAST RECOVERY	HITACHI EK32-20
CR[illegible]	[illegible]	DIODE VR=250V IO=200MA	HITACHI 1SS83
CR[illegible]	[illegible]	DIODE VR=250V IO=200MA	HITACHI 1SS83
CR[illegible]	[illegible]	DIODE VR=250V IO=200MA	HITACHI 1SS83
CR[illegible]	[illegible]	DIODE VR=250V IO=200MA	HITACHI 1SS83
CR[illegible]	[illegible]	DIODE VR=250V IO=200MA	HITACHI 1SS83
CR[illegible]	[illegible]	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR[illegible]	[illegible]	ZENER VZ=2.4-2.8V	HITACHI HZ2B-3
CR[illegible]	[illegible]	ZENER VZ=2.1-2.3V	HITACHI HZ2B-3
CR[illegible]	[illegible]	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR[illegible]	[illegible]	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR[illegible]	[illegible]	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR481	30-20-1951	DIODE VR=6KV FAST RECOVERY	SANKEN GHV-06SSN
CR[illegible]	30-20-1951	DIODE VR=6KV FAST RECOVERY	SANKEN GHV-06SSN
CR[illegible]	30-20-1951	DIODE VR=6KV FAST RECOVERY	SANKEN GHV-06SSN
CR484	30-20-1951	DIODE VR=6KV FAST RECOVERY	SANKEN GHV-06SSN
CR485	30-20-1951	DIODE VR=6KV FAST RECOVERY	SANKEN GHV-06SSN
CR486	30-20-1951	DIODE VR=6KV FAST RECOVERY	SANKEN GHV-06SSN
CR487	30-20-1951	DIODE VR=6KV FAST RECOVERY	SANKEN GHV-06SSN

Q401	30-10-8381	TR SI PNP	MATSUSHITA 2SA838-B
Q402	30-10-8381	TR SI PNP	MATSUSHITA 2SA838-B
Q403	31-20-1073	FET	SONY 2SK107-3
Q404	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q405	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q406	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q407	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q408	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q409	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q410	31-20-1171	FET	TOSHIBA 2SK117-BL
Q411	30-11-0151	TR SI PNP	TOSHIBA 2SA1015-Y
Q412	30-10-8381	TR SI PNP	MATSUSHITA 2SA838-B
Q413	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q415	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q416	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q417	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q418	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q419	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q420	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q421	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q422	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q423	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q424	30-31-8431	TR SI NPN	NEC 2SC1843-E
Q425	31-20-1171	FET	TOSHIBA 2SK117-BL
Q426	31-20-1171	FET	TOSHIBA 2SK117-BL
Q427	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q428	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q429	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q430	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q431	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q501	30-11-0151	TR SI PNP	TOSHIBA 2SA1015-Y
Q502	30-11-0151	TR SI PNP	TOSHIBA 2SA1015-Y
Q503	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q504	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q505	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q506	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q507	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q508	30-10-8381	TR SI PNP	MATSUSHITA 2SA838-B
Q509	30-20-6481	TR SI PNP	HITACHI 2SB648A

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	
Q510	30-40-6681	TR SI NPN	HITACHI 2SD668A-C
Q511	30-40-6681	TR SI NPN	HITACHI 2SD668A-C
Q512	30-20-6481	TR SI PNP	HITACHI 2SB648A
Q651	30-40-8602	TR SI NPN	NEC 2SD880-Y
Q652	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q654	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q655	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q656	30-32-3710	TR SI NPN	NEC 2SC2371-L
Q657	30-32-3710	TR SI NPN	NEC 2SC2371-L
Q658	30-32-3710	TR SI NPN	NEC 2SC2371-L
Q659	30-32-3710	TR SI NPN	NEC 2SC2371-L
Q660	31-20-1171	FET	TOSHIBA 2SK117-BL
U401	35-70-0004	QUAD 2-INPUT POSI-NAND	T.I SN74ALS00N
U402	35-70-1121	DUAL J-K F-F	T.I SN74LS112N
U403	34-00-0215	J-FET INPUT OPEAMP	N.S LF13741N
U404	34-69-0030	TRIPLE 2-CHANNEL MULTIPLEXER	TOSHIBA TC4053BP
U651	34-00-0215	J-FET INPUT OPEAMP	N.S LF13741N
R401	40-27-0472	FXD C FILM 47 OHM 5% 1/4W	
R402	42-72-3100	FXD M FILM 1K OHM 1% 1/4W	
R403	40-27-2222	FXD C FILM 2.2K OHM 5% 1/4W	
R404	40-27-2122	FXD C FILM 1.2K OHM 5% 1/4W	
R405	40-27-2222	FXD C FILM 2.2K OHM 5% 1/4W	
R406	40-27-2332	FXD C FILM 3.3K OHM 5% 1/4W	
R407	40-27-0472	FXD C FILM 47 OHM 5% 1/4W	
R408	40-27-3472	FXD C FILM 47K OHM 5% 1/4W	
R409	42-74-5100	FXD M FILM 1M OHM 1% 1/2W	
R410	40-27-3102	FXD C FILM 10K OHM 5% 1/4W	
R411	40-27-2152	FXD C FILM 1.5K OHM 5% 1/4W	
R412	40-27-1332	FXD C FILM 330 OHM 5% 1/4W	
R413	40-27-1562	FXD C FILM 560 OHM 5% 1/4W	
R414	40-27-0682	FXD C FILM 68 OHM 5% 1/4W	
R415	40-27-2392	FXD C FILM 3.9K OHM 5% 1/4W	
R416	40-27-2392	FXD C FILM 3.9K OHM 5% 1/4W	
R417	40-27-1682	FXD C FILM 680 OHM 5% 1/4W	
R418	40-27-1682	FXD C FILM 680 OHM 5% 1/4W	
R419	40-27-1682	FXD C FILM 680 OHM 5% 1/4W	
R420	40-27-1682	FXD C FILM 680 OHM 5% 1/4W	
R421	40-27-4102	FXD C FILM 100K OHM 5% 1/4W	
R422	40-27-4102	FXD C FILM 100K OHM 5% 1/4W	
R423	40-27-2222	FXD C FILM 2.2K OHM 5% 1/4W	
R424	40-27-3223	FXD C FILM 22K OHM 5% 1/4W	
R425	40-27-3102	FXD C FILM 10K OHM 5% 1/4W	
R427	40-27-3102	FXD C FILM 10K OHM 5% 1/4W	
R428	40-27-0332	FXD C FILM 33 OHM 5% 1/4W	
R429	40-27-1562	FXD C FILM 560 OHM 5% 1/4W	
R431	40-27-3102	FXD C FILM 10K OHM 5% 1/4W	
R432	40-27-2102	FXD C FILM 1K OHM 5% 1/4W	
R433	40-27-4472	FXD C FILM 470K OHM 5% 1/4W	
R434	40-27-4472	FXD C FILM 470K OHM 5% 1/4W	
R435	40-27-1392	FXD C FILM 390 OHM 5% 1/4W	
R436	40-27-1102	FXD C FILM 100 OHM 5% 1/4W	
R437	40-27-1272	FXD C FILM 270 OHM 5% 1/4W	
R438	40-27-1222	FXD C FILM 220 OHM 5% 1/4W	
R440	40-27-2222	FXD C FILM 2.2K OHM 5% 1/4W	
R441	40-27-2222	FXD C FILM 2.2K OHM 5% 1/4W	
R442	40-27-8479	FXD C FILM 4.7 OHM 5% 1/4W	
R443	40-27-3472	FXD C FILM 47K OHM 5% 1/4W	
R451	- -		
R452	40-27-1332	FXD C FILM 330 OHM 5% 1/4W	
R453	40-27-0222	FXD C FILM 22 OHM 5% 1/4W	
R454	40-27-3472	FXD C FILM 47K OHM 5% 1/4W	
R455	40-27-2182	FXD C FILM 1.8K OHM 5% 1/4W	
R456	40-27-3102	FXD C FILM 10K OHM 5% 1/4W	
R458	40-27-3102	FXD C FILM 10K OHM 5% 1/4W	
R459	40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W	
R460	40-27-3472	FXD C FILM 47K OHM 5% 1/4W	
R461	42-72-3220	FXD M FILM 22K OHM 1% 1/4W	
R462	42-72-3330	FXD M FILM 33K OHM 1% 1/4W	
R463	40-27-2272	FXD C FILM 2.7K OHM 5% 1/4W	
R464	40-27-2472	FXD C FILM 4.7K OHM 5% 1/4W	
R466	40-27-2102	FXD C FILM 1K OHM 5% 1/4W	
R467	40-27-0472	FXD C FILM 47 OHM 5% 1/4W	
R468	40-27-2222	FXD C FILM 2.2K OHM 5% 1/4W	
R469	40-27-3102	FXD C FILM 10K OHM 5% 1/4W	
R470	40-27-1822	FXD C FILM 820 OHM 5% 1/4W	

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.		DESCRIPTION		
R471	40-27-3562	[illegible]	FILM	56K	OHM 5% 1/4W
R472	[illegible]	[illegible]	FILM	2.2K	OHM 5% 1/4W
R473	[illegible]	[illegible]	FILM	1.2K	OHM 5% 1/4W
R474	*				
R475	[illegible]	[illegible]	FILM	3.9K	OHM 5% 1/4W
R476	[illegible]	[illegible]	FILM	18K	OHM 5% 1/4W
R477	[illegible]	[illegible]	FILM	220	OHM 5% 1/4W
R478	[illegible]	[illegible]	FILM	2.2K	OHM 1% 1/4W
R479	[illegible]	[illegible]	FILM	470K	OHM 5% 1/4W
R480	[illegible]	[illegible]	FILM	10K	OHM 5% 1/4W
R481	[illegible]	[illegible]	FILM	33K	OHM 5% 1/4W
R482	[illegible]	[illegible]	FILM	10K	OHM 5% 1/4W
R483	[illegible]	[illegible]	FILM	4.7K	OHM 5% 1/4W
R484	[illegible]	[illegible]	FILM	1.6K	OHM 1% 1/4W
R485	[illegible]	[illegible]	FILM	100K	OHM 5% 1/4W
R486	[illegible]	[illegible]	FILM	3.3K	OHM 5% 1/4W
R487	[illegible]	[illegible]	FILM	10	OHM 5% 1/4W
R488	[illegible]	[illegible]	FILM	10	OHM 5% 1/4W
R489	[illegible]	[illegible]	FILM	10	OHM 5% 1/4W
R491	[illegible]	[illegible]	GLAZE	5M	OHM 1% 0.31W
R492	[illegible]	[illegible]	FILM	1M	OHM 1% 1/2W
R493	[illegible]	[illegible]	GLAZE	R-NETWORK	KIKUSUI S8109011
R494	[illegible]	[illegible]	FILM	3.9K	OHM 1% 1/4W
R495	[illegible]	[illegible]	FILM	470	OHM 1% 1/4W
R496	[illegible]	[illegible]	FILM	10K	OHM 5% 1/4W
R498	[illegible]	[illegible]	FILM	560	OHM 5% 1/4W
R499	[illegible]	[illegible]	FILM	100	OHM 5% 1/4W
R501	[illegible]	[illegible]	FILM	6.8K	OHM 5% 1/4W
R502	[illegible]	[illegible]	FILM	470	OHM 5% 1/4W
R503	[illegible]	[illegible]	FILM	56	OHM 1% 1/4W
R504	[illegible]	[illegible]	FILM	5.6K	OHM 5% 1/4W
R505	[illegible]	[illegible]	FILM	5.6K	OHM 5% 1/4W
R506	[illegible]	[illegible]	FILM	5.6K	OHM 5% 1/4W
R507	[illegible]	[illegible]	FILM	5.6K	OHM 5% 1/4W
R508	[illegible]	[illegible]	FILM	1K	OHM 1% 1/4W
R509	[illegible]	[illegible]	FILM	1K	OHM 1% 1/4W
R510	[illegible]	[illegible]	FILM	1K	OHM 1% 1/4W
R511	[illegible]	[illegible]	FILM	560	OHM 1% 1/4W
R512	[illegible]	[illegible]	FILM	330	OHM 5% 1/4W
R513	[illegible]	[illegible]	FILM	330	OHM 5% 1/4W
R514	[illegible]	[illegible]	FILM	12K	OHM 5% 1/4W
R515	[illegible]	[illegible]	FILM	100K	OHM 5% 1/4W
R516	[illegible]	[illegible]	FILM	2.2K	OHM 5% 1/4W
R517	[illegible]	[illegible]	FILM	2.2K	OHM 5% 1/4W
R518	[illegible]	[illegible]	FILM	100K	OHM 1% 1/4W
R519	[illegible]	[illegible]	FILM	100K	OHM 1% 1/4W
R520	[illegible]	[illegible]	FILM	100K	OHM 5% 1/4W
R521	[illegible]	[illegible]	FILM	100K	OHM 5% 1/4W
R522	[illegible]	[illegible]	FILM	1.5K	OHM 5% 1/4W
R523	40-27-1332	[illegible]	FILM	330	OHM 5% 1/4W
R524	40-27-2152	[illegible]	FILM	1.5K	OHM 5% 1/4W
R525	40-27-1332	[illegible]	FILM	330	OHM 5% 1/4W
R526	40-27-0472	[illegible]	FILM	47	OHM 5% 1/4W
R527	40-27-0472	[illegible]	FILM	47	OHM 5% 1/4W
R528	*				
R531	42-72-2820	[illegible]	FILM	8.2K	OHM 1% 1/4W
R532	42-72-3120	[illegible]	FILM	12K	OHM 1% 1/4W
R533	* 40-27-4122	[illegible]	FILM	120K	OHM 5% 1/4W
R534	42-72-4100	[illegible]	FILM	100K	OHM 1% 1/4W
R535	40-27-2102	[illegible]	FILM	1K	OHM 5% 1/4W
R537	44-91-0010	[illegible]	OXIDE	1	OHM 5% 1W
R538	40-27-2472	[illegible]	FILM	4.7K	OHM 5% 1/4W
R539	40-27-1472	[illegible]	FILM	470	OHM 5% 1/4W
R541	42-44-0310	[illegible]	GLAZE	6.8M	OHM 1% 1.6W
R542	42-44-0300	[illegible]	GLAZE	10M	OHM 1% 2.5W
R543	40-27-2102	[illegible]	FILM	1K	OHM 5% 1/4W
R544	40-27-3102	[illegible]	FILM	10K	OHM 5% 1/4W
R545	40-37-5221	[illegible]	FILM	2.2M	OHM 5% 1/2W
R546	40-37-6101	[illegible]	FILM	10M	OHM 5% 1/2W
R547	40-37-6101	[illegible]	FILM	10M	OHM 5% 1/2W
R548	40-27-2332	[illegible]	FILM	3.3K	OHM 5% 1/4W
R549	40-37-5151	[illegible]	FILM	1.5M	OHM 5% 1/2W
R550	40-27-3272	[illegible]	FILM	27K	OHM 5% 1/4W
R551	40-27-4102	[illegible]	FILM	100K	OHM 5% 1/4W
R552	40-27-3102	[illegible]	FILM	10K	OHM 5% 1/4W
R553	40-37-6101	[illegible]	FILM	10M	OHM 5% 1/2W
R554	40-37-6101	[illegible]	FILM	10M	OHM 5% 1/2W

REFERENCE DESIGNATOR		KIKUSUI PARTS NO.	DESCRIPTION
R476		40-37-5151	FXD C FILM 1.5M OHM 5% 1/2W
R477		40-27-1102	FXD C FILM 100 OHM 5% 1/4W
R478		40-27-1102	FXD C FILM 100 OHM 5% 1/4W
R479		40-27-1102	FXD C FILM 100 OHM 5% 1/4W
R480		40-27-4472	FXD C FILM 470K OHM 5% 1/4W
R481		40-27-2182	FXD C FILM 1.8K OHM 5% 1/4W
R483		40-27-2332	FXD C FILM 3.3K OHM 5% 1/4W
R484		40-27-2222	FXD C FILM 2.2K OHM 5% 1/4W
R485		40-27-1102	FXD C FILM 100 OHM 5% 1/4W
R486		40-27-1222	FXD C FILM 220 OHM 5% 1/4W
R487		40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W
R488		40-27-1332	FXD C FILM 330 OHM 5% 1/4W
R489		40-27-2472	FXD C FILM 4.7K OHM 5% 1/4W
R490		40-37-3471	FXD C FILM 47K OHM 5% 1/2W
R491		40-37-3471	FXD C FILM 47K OHM 5% 1/2W
R492		40-37-3471	FXD C FILM 47K OHM 5% 1/2W
R493		40-27-1682	FXD C FILM 680 OHM 5% 1/4W
R494		40-27-1682	FXD C FILM 680 OHM 5% 1/4W
R495		40-37-3471	FXD C FILM 47K OHM 5% 1/2W
R496		40-27-1102	FXD C FILM 100 OHM 5% 1/4W
R497		40-27-4103	FXD C FILM 100K OHM 5% 1/4W
R498	*	40-27-3392	FXD C FILM 39K OHM 5% 1/4W
R499		40-27-3562	FXD C FILM 56K OHM 5% 1/4W
R1401		40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R1403		40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R1404		40-27-4472	FXD C FILM 470K OHM 5% 1/4W
R1405		40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R1652		40-27-3153	FXD C FILM 15K OHM 5% 1/4W
R1654		40-27-2332	FXD C FILM 3.3K OHM 5% 1/4W
R1661		40-37-6101	FXD C FILM 10M OHM 5% 1/2W
R1662		40-37-3221	FXD C FILM 22K OHM 5% 1/2W
RV401		48-33-2500	VAR M FILM 5K OHM
RV404		48-33-4500	VAR M FILM 500K OHM
RV405		48-33-3100	VAR M FILM 10K OHM
RV651		48-36-5220	VAR M GLAZE 2.2M OHM
RV652		48-33-4100	VAR M FILM 100K OHM
RV653		48-33-3200	VAR M FILM 20K OHM
C401		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2
C402		50-67-0040	FXD PLSTC FILM 0.022UF 10% 100V
C403		52-06-3185	FXD CER 47PF 10% 500V TYPE1
C404		52-06-3185	FXD CER 47PF 10% 500V TYPE1
C405	*	52-01-3305	FXD CER 470PF 10% 500V TYPE2
C406		54-00-0114	FXD ELECT 47UF 25V
C407		54-00-0114	FXD ELECT 47UF 25V
C408		54-00-0311	FXD ELECT 10UF 50V
C409		54-00-0311	FXD ELECT 10UF 50V
C410		54-00-0311	FXD ELECT 10UF 50V
C411	*	52-06-3145	FXD CER 22PF 10% 500V TYPE1
C431		55-37-2050	FXD TANT ELECT 1UF 35V
C432		54-00-0311	FXD ELECT 10UF 50V
C433		50-67-0030	FXD PLSTC FILM 0.01UF 10% 100V
C451		52-06-3185	FXD CER 47PF 10% 500V TYPE1
C452		54-00-0311	FXD ELECT 10UF 50V
C454		52-01-3345	FXD CER 1000PF 10% 500V TYPE2
C455		52-06-3185	FXD CER 47PF 10% 500V TYPE1
C456		54-00-0311	FXD ELECT 10UF 50V
C457		54-00-0114	FXD ELECT 47UF 25V
C458		52-06-2225	FXD CER 100PF 10% 50V TYPE1
C459		50-65-0530	FXD M PLSTC FILM 1000PF 5% 100V
C460		50-65-0540	FXD M PLSTC FILM 1UF 5% 100V
C461		54-00-0114	FXD ELECT 47UF 25V
C462		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2
C463		54-00-0311	FXD ELECT 10UF 50V
C464		54-00-0311	FXD ELECT 10UF 50V
C465		52-06-3125	FXD CER 15PF 10% 500V TYPE1
C467		52-01-3345	FXD CER 1000PF 10% 500V TYPE2
C468		50-67-0030	FXD PLSTC FILM 0.01UF 10% 100V
C469		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2
C503		52-03-3469	FXD CER 0.01UF +100-0% 500V TYPE2
C504		52-03-3469	FXD CER 0.01UF +100-0% 500V TYPE2
C506		52-03-3469	FXD CER 0.01UF +100-0% 500V TYPE2
C507		52-03-3469	FXD CER 0.01UF +100-0% 500V TYPE2
C508		54-00-0311	FXD ELECT 10UF 50V
C509		52-03-3469	FXD CER 0.01UF +100-0% 500V TYPE2
C510		54-00-0311	FXD ELECT 10UF 50V

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	
C511	* -	**********	
C651	54-00-0311	FXD ELECT 10UF 50V	
C652	54-00-0311	FXD ELECT 10UF 50V	
C653	52-01-3365	FXD CER 1500PF 10% 50V TYPE2	
C654	50-67-0040	FXD PLSTC FILM 0.022UF 10% 100V	
C655	54-00-0312	FXD ELECT 22UF 50V	
C656	54-37-2050	FXD TANT ELECT 1UF 35V	
C657	52-98-1000	FXD CER 4700PF +80-20% 3.15KV TYPE1	
C660	52-98-1010	FXD CER 1000PF +80-20% 6.3KV TYPE1	
C661	52-98-1010	FXD CER 1000PF +80-20% 6.3KV TYPE1	
C662	52-98-1010	FXD CER 1000PF +80-20% 6.3KV TYPE1	
C663	52-98-1010	FXD CER 1000PF +80-20% 6.3KV TYPE1	
C664	52-03-3469	FXD CER 0.01UF +100-0% 500V TYPE2	
C665	52-98-1010	FXD CER 1000PF +80-20% 6.3KV TYPE1	
C666	52-98-1010	FXD CER 1000PF +80-20% 6.3KV TYPE1	
C667	52-08-5145	FXD CER 22PF 10% 2KV TYPE1	
C668	50-67-0040	FXD PLSTC FILM 0.022UF 10% 100V	
C671	52-98-1010	FXD CER 1000PF +80-20% 6.3KV TYPE1	
C672	52-98-1010	FXD CER 1000PF +80-20% 6.3KV TYPE1	
C673	52-98-1010	FXD CER 1000PF +80-20% 6.3KV TYPE1	
C674	52-98-1010	FXD CER 1000PF +80-20% 6.3KV TYPE1	
C675	52-98-1010	FXD CER 1000PF +80-20% 6.3KV TYPE1	
C676	52-98-1010	FXD CER 1000PF +80-20% 6.3KV TYPE1	
C677	52-98-1000	FXD CER 4700PF +80-20% 3.15KV TYPE1	
C678	52-98-1000	FXD CER 4700PF +80-20% 3.15KV TYPE1	
C679	52-98-1000	FXD CER 4700PF +80-20% 3.15KV TYPE1	
C681	52-03-3469	FXD CER 0.01UF +100-0% 500V TYPE2	
C682	52-04-2522	FXD CER 2200PF 10% 500V TYPE1	
C683	54-00-0311	FXD ELECT 10UF 50V	
C684	54-00-0311	FXD ELECT 10UF 50V	
C685	52-03-3469	FXD CER 0.01UF +100-0% 500V TYPE2	
C686	54-00-0311	FXD ELECT 10UF 50V	
C687	52-03-3469	FXD CER 0.01UF +100-0% 500V TYPE2	
C688	52-03-3462	FXD CER 0.01UF +80-20% 50V TYPE2	
C689	52-03-3462	FXD CER 0.01UF +80-20% 50V TYPE2	
DS651	34-79-0000	LAMP NEON	
DS652	34-79-0000	LAMP NEON	
L650	77-10-0890	INDUCTOR 100UH 10%	
S401	90-76-3434	LEVER SWITCH	ALPS SLR524-2
S402	90-76-3434	LEVER SWITCH	ALPS SLR524-2
S403	90-76-3422	PUSH SWITCH	ALPS SLRC12-2
S406	90-98-0470	SW ROTARY WITH 5V SWEEP DIV	ALPS SRUF24-1
T651	77-62-0136	CONVERTOR POWER	KIKUSUI S810115
A4 ASSEMBLY			
CR1601	90-76-3440	DIODE BRIDGE 35A 200V	HITACHI HZ36L-2
CR1602	90-76-3440	DIODE BRIDGE 35A 200V	HITACHI HZ36L-2
CR1603	90-76-3440	DIODE BRIDGE 35A 200V	HITACHI HZ36L-2
CR1604	90-76-3440	DIODE BRIDGE 35A 200V	HITACHI HZ36L-2
CR1605	90-66-0000	DIODE ZENER	TOSHIBA TLG-105
Q1601	70-31-1846	TR SI NPN	MATSUSHITA 2SC1846-R
Q1602	70-31-1846	TR SI NPN	MATSUSHITA 2SC1846-R
U1601	90-60-0000	DUAL 2-INPUT GATE CMOS	TOSHIBA TC4011BP
R1601 *	40-27-4102	FXD C FILM 100K OHM 5% 1/4W	
R1602	40-27-3103	FXD C FILM 10K OHM 5% 1/4W	
R1603	40-27-3103	FXD C FILM 10K OHM 5% 1/4W	
R1604	40-27-4102	FXD C FILM 100K OHM 5% 1/4W	
R1605	40-27-4102	FXD C FILM 100K OHM 5% 1/4W	
R1606	40-27-4682	FXD C FILM 6.8K OHM 5% 1/4W	
R1607	40-27-4472	FXD C FILM 4.7K OHM 5% 1/4W	
R1608	40-27-4474	FXD C FILM 470K OHM 5% 1/4W	
R1609	40-27-1472	FXD C FILM 4.7K OHM 5% 1/4W	
R1610	40-72-7100	FXD M FILM 10K OHM 1% 1/4W	
R1611 *	40-27-4102	FXD C FILM 100K OHM 5% 1/4W	
R1612	43-72-2200	FXD M FILM 20 OHM 1% 1/4W	
R1613	40-27-0102	FXD C FILM 10 OHM 5% 1/4W	
R1614	40-27-1682	FXD C FILM 6.8K OHM 5% 1/4W	
R1615	40-27-8472	FXD C FILM 4.7 OHM 5% 1/4W	
R1616	40-27-1562	FXD C FILM 5.6K OHM 5% 1/4W	
RV1601	43-44-1100	VAR C COMP 10K OHM	

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	
RV1603	45-44-4200	VAR C COMP 200K OHM	
RV1604	45-43-2200	VAR M GLAZE 2K OHM	
RV1605	45-44-3100	VAR C COMP 10K OHM	
C1605	50-45-0500	FXD PLSTC FILM 0.01MF 5% 50V	
C1606	50-45-0500	FXD PLSTC FILM 0.01MF 5% 50V	
C1607	52-06-4051	FXD CER 5PF [illegible]	
C1608	52-01-1345	FXD CER [illegible] 10% 500V TYPE2	
C1609	54-06-0114	FXD ELECT 47UF 25V	
C1610	52-03-3469	FXD CER 0.01UF +100-0% 500V TYPE2	
DS1601	23-44-0000	LAMP 14V 80MA	
DS1602	23-44-0000	LAMP 14V 80MA	
B ASSEMBLY			
CR409	37-00-0082	LAMP LED RED	[illegible] TLR102KW
CR451	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
R101	40-27-0222	FXD C FILM 22 OHM 5% 1/4W	
R201	40-27-0222	FXD C FILM 22 OHM 5% 1/4W	
R456	40-27-2822	FXD C FILM 8.2K OHM 5% 1/4W	
R457	40-27-3102	FXD C FILM 10K OHM 5% 1/4W	
R1402	40-27-0562	FXD C FILM 56 OHM 5% 1/4W	
RV111	45-01-0700	VAR C COMP 10K OHM WITH SW	
RV211	45-01-0700	VAR C COMP 10K OHM WITH SW	
RV402	45-01-0550	VAR C COMP 10K/100K OHM B	
RV406	45-01-0690	VAR C COMP 10K OHM WITH SW	
RV501	45-35-3103	VAR C COMP 10K OHM	
C110	52-06-2225	FXD CER 100PF 10% 50V TYPE1	
C210	52-06-2225	FXD CER 100PF 10% 50V TYPE1	
C453	52-01-3345	FXD CER 1000PF [illegible]	
C466	52-05-1498	FXD CER 0.1UF [illegible]	
C601	52-77-1000	FXD CER 100PF [illegible]	
C602	52-77-1000	FXD CER 100PF [illegible]	
DL301	91-90-0003	DELAY LINE 1.3M [illegible]	
S404	81-03-0270	PUSH SWITCH	ALPS SUE30
S1601	81-01-0270	PUSH SWITCH	ALPS SDGSP-E
T601	60-44-0110	POWER TRANS	KIKUSUI S820041
V601	21-46-0604	CRT	[illegible]

REPLACEABLE PARTS
FOR COS5041

ABBREVIATIONS

CER:	CERAMIC
C FILM:	CARBON FILM
C COMP:	CARBON COMPOSITION
CRT:	CATHODE RAY TUBE
ELECT:	ELECTROLYTIC
FET:	FIELD EFFECT TRANSISTOR
FXD:	FIXED
LED:	LIGHT EMITTING DIODE
M FILM:	METAL FILM
M GLAZE:	METAL GLAZE
M OX:	METAL OXIDE
M PLSTC FILM:	METALLIZED PLASTIC FILM
PLSTC FILM:	PLASTIC FILM
Si:	SILICON
TANT ELECT:	TANTALUM ELECTROLYTIC
VAR:	VARIABLE
WW:	WIREWOUND
*:	OPTIMUM VALUE SELECTED AT FACTORY. AVERAGE VALUE SHOWN.(PART MAY BE OMITTED.)

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION			
A1	ASSEMBLY				
CR101	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR102	30-90-0063	ZENER	VZ=3.2-3.4V		HITACHI HZ3C-2
CR103	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR104	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR105	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR106	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR107	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR108	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR201	30-90-0063	ZENER	VZ=3.2-3.4V		HITACHI HZ3C-2
CR203	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR204	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR205	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR206	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR207	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR208	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR301	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR302	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR303	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR304	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR305	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR306	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR307	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR308	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR309	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR311	30-90-0072	ZENER	VZ=2.1-2.3V		HITACHI HZ2B-3
CR314	30-90-0063	ZENER	VZ=2.1-2.2V		HITACHI HZ2B-3
CR317	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR318	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR319	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR320	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CRA21	30-90-2110	DIODE	BRIDGE	VRM=400V IO=1A	TOSHIBA 1G4B42
CRA22	30-90-2110	DIODE	BRIDGE	VRM=400V IO=1A	TOSHIBA 1G4B42
CR323	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR324	30-90-0130	ZENER	VZ=12.41-13.05V	P=0.4W	NEC RD13.1
CR325	30-90-0130	ZENER	VZ=12.41-13.05V	P=0.4W	NEC RD13.1
CR326	30-11-5880	DIODE	VR=30V	IO=120MA	TOSHIBA 1S1588
CR327	30-90-0056	ZENER	VZ=5.5-5.8V	P=0.4W	NEC RD5.6J
Q101	31-20-1073	FET			SONY 2SK107-3
Q102	30-30-9451	TR SI NPN			NEC 2SC945-Q
Q103	30-10-8441	TR SI PNP			HITACHI 2SA844-D
Q104	30-30-9451	TR SI NPN			NEC 2SC945-Q
Q105	30-11-2061	TR SI PNP			NEC 2SA1206-L
Q106	30-11-2061	TR SI PNP			NEC 2SA1206-L
Q107	30-10-8381	TR SI PNP			MATSUSHITA 2SA838-B
Q108	30-10-8381	TR SI PNP			MATSUSHITA 2SA838-B
Q109	30-31-9071	TR SI NPN			HITACHI 2SC1907
Q110	30-10-8381	TR SI PNP			MATSUSHITA 2SA838-B
Q111	30-10-8381	TR SI PNP			MATSUSHITA 2SA838-B
Q201	31-20-1073	FET			SONY 2SK107-3
Q202	30-30-9451	TR SI NPN			NEC 2SC945-Q
Q203	30-10-8441	TR SI PNP			HITACHI 2SA844-D
Q204	30-30-9451	TR SI NPN			NEC 2SC945-Q
Q205	30-11-2061	TR SI PNP			NEC 2SA1206-L
Q206	30-11-2061	TR SI PNP			NEC 2SA1206-L
Q207	30-10-8381	TR SI PNP			MATSUSHITA 2SA838-B
Q208	30-10-8381	TR SI PNP			MATSUSHITA 2SA838-B
Q210	30-10-8381	TR SI PNP			MATSUSHITA 2SA838-B
Q211	30-10-8381	TR SI PNP			MATSUSHITA 2SA838-B
Q212	30-10-8381	TR SI PNP			MATSUSHITA 2SA838-B
Q213	30-10-8381	TR SI PNP			MATSUSHITA 2SA838-B
Q301	30-11-2061	TR SI PNP			NEC 2SA1206-L
Q302	30-11-2061	TR SI PNP			NEC 2SA1206-L
Q303	30-10-8441	TR SI PNP			HITACHI 2SA844-D
Q304	30-10-8441	TR SI PNP			HITACHI 2SA844-D
Q305	30-31-9071	TR SI NPN			HITACHI 2SC1907
Q306	30-31-9071	TR SI NPN			HITACHI 2SC1907
Q307	30-31-7501	TR SI NPN			NEC 2SC1750-L
Q308	30-11-2061	TR SI PNP			NEC 2SA1206-L
Q309	30-11-2061	TR SI PNP			NEC 2SA1206-L
Q310	30-31-7501	TR SI NPN			NEC 2SC1750-L
Q311	30-32-7041	TR SI NPN			NEC 2SC2570
Q312	30-11-1441	TR SI PNP			TOSHIBA 2SA1144-O
Q313	30-32-7041	TR SI NPN			TOSHIBA 2SC2704-O
Q314	30-32-7041	TR SI NPN			TOSHIBA 2SC2704-O
Q315	30-11-1441	TR SI PNP			TOSHIBA 2SA1144-O

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	
Q316	30-32-5700	TR SI NPN	NEC 2SC2570
Q403	30-20-8611	TR SI PNP	HITACHI 2SB861-C
Q604	30-20-8341	TR SI PNP	TOSHIBA 2SB834-Y
Q605	30-40-8802	TR SI NPN	NEC 2SD880-Y
Q606	30-40-8802	TR SI NPN	NEC 2SD880-Y
QCR101	30-31-9071	TR SI NPN	HITACHI 2SC1907
QCR201	30-31-9071	TR SI NPN	HITACHI 2SC1907
U101	34-00-0121	FET OPEAMP	N.S LF13741N
U102	30-90-0141	TRANSISTOR ARRAYS 5 NPN	RCA CA3086
U201	34-00-0121	FET OPEAMP	N.S LF13741N
U202	30-90-0141	TRANSISTOR ARRAYS 5 NPN	RCA CA3086
U301	35-70-0741	DUAL D-FLIP FLOP	T.I SN74LS74N
U302	35-70-0001	QUAD 2-INPUT POSI-NAND	T.I SN74LS00N
U602	34-00-0240	DUAL OPEAMP	NEC UPC4558C
U603	34-00-0240	DUAL OPEAMP	NEC UPC4558C
R102	40-27-0332	FXD C FILM 33 OHM 5% 1/4W	
R103	42-74-5100	FXD M FILM 1M OHM 1% 1/2W	
R104	42-74-4900	FXD M FILM 900K OHM 1% 1/2W	
R105	42-72-4111	FXD M FILM 111K OHM 1% 1/4W	
R106	42-74-4990	FXD M FILM 990K OHM 1% 1/2W	
R107	42-72-3101	FXD M FILM 10.1K OHM 1% 1/4W	
R108	40-27-0222	FXD C FILM 22 OHM 5% 1/4W	
R109	40-27-0682	FXD C FILM 68 OHM 5% 1/4W	
R110	40-27-0102	FXD C FILM 10 OHM 5% 1/4W	
R111	40-37-4471	FXD C FILM 470K OHM 5% 1/2W	
R112	40-27-2102	FXD C FILM 1K OHM 5% 1/4W	
R113	40-27-2102	FXD C FILM 1K OHM 5% 1/4W	
R114	40-27-1392	FXD C FILM 390 OHM 5% 1/4W	
R115	40-27-1102	FXD C FILM 100 OHM 5% 1/4W	
R116	40-27-1682	FXD C FILM 680 OHM 5% 1/4W	
R117	40-27-2392	FXD C FILM 3.9K OHM 5% 1/4W	
R118	40-27-2822	FXD C FILM 8.2K OHM 5% 1/4W	
R119	40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W	
R120	40-27-2122	FXD C FILM 1.2K OHM 5% 1/4W	
R121	40-27-0102	FXD C FILM 10 OHM 5% 1/4W	
R122	40-27-0102	FXD C FILM 10 OHM 5% 1/4W	
R123	44-04-0000	FXD M GLAZE R-NETWORK	KIKUSUI S8109001
R124	38-00-0000	THERMISTER 250 OHM	
R131	40-27-1102	FXD C FILM 100 OHM 5% 1/4W	
R132	40-27-1122	FXD C FILM 120 OHM 5% 1/4W	
R133	40-27-1122	FXD C FILM 120 OHM 5% 1/4W	
R134	40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W	
R135	40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W	
R136	40-27-1682	FXD C FILM 680 OHM 5% 1/4W	
R137	40-27-3472	FXD C FILM 47K OHM 5% 1/4W	
R138	40-27-1102	FXD C FILM 100 OHM 5% 1/4W	
R139	42-72-1470	FXD M FILM 470 OHM 1% 1/4W	
R140	40-27-1272	FXD C FILM 270 OHM 5% 1/4W	
R141	42-72-1470	FXD M FILM 470 OHM 1% 1/4W	
R142	42-72-0560	FXD M FILM 56 OHM 1% 1/4W	
R144	42-72-0560	FXD M FILM 56 OHM 1% 1/4W	
R145	40-27-3472	FXD C FILM 47K OHM 5% 1/4W	
R146	40-27-0272	FXD C FILM 27 OHM 5% 1/4W	
R147	40-27-0272	FXD C FILM 27 OHM 5% 1/4W	
R148	42-72-1680	FXD M FILM 680 OHM 1% 1/4W	
R149	42-72-1680	FXD M FILM 680 OHM 1% 1/4W	
R150	40-27-0222	FXD C FILM 22 OHM 5% 1/4W	
R151	40-27-0222	FXD C FILM 22 OHM 5% 1/4W	
R152	40-27-1152	FXD C FILM 150 OHM 5% 1/4W	
R153	40-27-1152	FXD C FILM 150 OHM 5% 1/4W	
R154	40-27-0222	FXD C FILM 22 OHM 5% 1/4W	
R155	42-72-2100	FXD M FILM 1K OHM 1% 1/4W	
R156	42-72-2100	FXD M FILM 1K OHM 1% 1/4W	
R157	40-27-1222	FXD C FILM 220 OHM 5% 1/4W	
R158 *	40-27-2102	FXD C FILM 1K OHM 5% 1/4W	
R159	40-27-2392	FXD C FILM 3.9K OHM 5% 1/4W	
R160	40-27-0102	FXD C FILM 10 OHM 5% 1/4W	
R161	40-27-2152	FXD C FILM 1.5K OHM 5% 1/4W	
R162	40-27-0472	FXD C FILM 47 OHM 5% 1/4W	
R171	40-27-1122	FXD C FILM 120 OHM 5% 1/4W	
R172	40-27-2152	FXD C FILM 1.5K OHM 5% 1/4W	
R173	40-27-2152	FXD C FILM 1.5K OHM 5% 1/4W	
R174	40-27-1182	FXD C FILM 180 OHM 5% 1/4W	
R175	40-27-1182	FXD C FILM 180 OHM 5% 1/4W	

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION
R176	40-27-1272	FXD C FILM 270 OHM 5% 1/4W
R177	40-27-2472	FXD C FILM 4.7K OHM 5% 1/4W
R178	40-27-2472	FXD C FILM 4.7K OHM 5% 1/4W
R179	40-27-0472	FXD C FILM 47 OHM 5% 1/4W
R180	40-27-0472	FXD C FILM 47 OHM 5% 1/4W
R186	40-27-0222	FXD C FILM 22 OHM 5% 1/4W
R187	40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W
R189	38-00-0000	THERMISTOR 250 OHM
R202	40-27-0332	FXD C FILM 33 OHM 5% 1/4W
R203	42-74-5100	FXD M FILM 1M OHM 1% 1/2W
R204	42-74-4900	FXD M FILM 900K OHM 1% 1/2W
R205	42-72-4111	FXD M FILM 111K OHM 1% 1/4W
R206	42-74-4990	FXD M FILM 990K OHM 1% 1/2W
R207	42-72-3101	FXD M FILM 10.1K OHM 1% 1/4W
R208	40-27-0222	FXD C FILM 22 OHM 5% 1/4W
R209	40-27-0682	FXD C FILM 68 OHM 5% 1/4W
R210	40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R211	40-57-4471	FXD C FILM 470K OHM 5% 1/2W
R212	40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R213	40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R214	40-27-1392	FXD C FILM 390 OHM 5% 1/4W
R215	40-27-1103	FXD C FILM 10K OHM 5% 1/4W
R216	40-27-1682	FXD C FILM 680 OHM 5% 1/4W
R217	40-27-2392	FXD C FILM 3.9K OHM 5% 1/4W
R218	40-27-2822	FXD C FILM 8.2K OHM 5% 1/4W
R219	40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W
R220	40-27-2122	FXD C FILM 1.2K OHM 5% 1/4W
R221	40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R222	40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R223	44-04-0000	FXD M GLAZE R-NETWORK KIKUSUI S8109001
R224	38-00-0000	THERMISTOR 250 OHM
R231	40-27-1102	FXD C FILM 1K OHM 5% 1/4W
R232	40-27-1122	FXD C FILM 1.1K OHM 5% 1/4W
R233	40-27-1122	FXD C FILM 1.1K OHM 5% 1/4W
R234	40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W
R235	40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W
R236	40-27-1682	FXD C FILM 680 OHM 5% 1/4W
R237	40-27-3472	FXD C FILM 47K OHM 5% 1/4W
R238	40-27-1102	FXD C FILM 100 OHM 5% 1/4W
R239	42-72-1470	FXD M FILM 470 OHM 1% 1/4W
R240	40-27-1272	FXD C FILM 270 OHM 5% 1/4W
R241	42-72-1470	FXD M FILM 470 OHM 1% 1/4W
R242	42-72-0560	FXD M FILM 56 OHM 1% 1/4W
R244	42-72-0560	FXD M FILM 56 OHM 1% 1/4W
R245	40-27-3472	FXD C FILM 47K OHM 5% 1/4W
R246	40-27-0272	FXD C FILM 27 OHM 5% 1/4W
R247	40-27-0472	FXD C FILM 47 OHM 5% 1/4W
R248	42-72-1680	FXD M FILM 680 OHM 1% 1/4W
R249	42-72-1680	FXD M FILM 680 OHM 1% 1/4W
R250	40-27-0222	FXD C FILM 22 OHM 5% 1/4W
R251	40-27-0222	FXD C FILM 22 OHM 5% 1/4W
R252	40-27-1152	FXD C FILM 150 OHM 5% 1/4W
R253	40-27-1152	FXD C FILM 150 OHM 5% 1/4W
R254	40-27-0822	FXD C FILM 82 OHM 5% 1/4W
R255	42-72-2100	FXD M FILM 1K OHM 1% 1/4W
R256	42-72-2100	FXD M FILM 1K OHM 1% 1/4W
R257	40-27-1222	FXD C FILM 220 OHM 5% 1/4W
R258	40-27-1222	FXD C FILM 220 OHM 5% 1/4W
R271	40-27-1122	FXD C FILM 120 OHM 5% 1/4W
R272	40-27-2152	FXD C FILM 1.5K OHM 5% 1/4W
R273	40-27-2152	FXD C FILM 1.5K OHM 5% 1/4W
R274	40-27-1182	FXD C FILM 180 OHM 5% 1/4W
R275	40-27-1182	FXD C FILM 180 OHM 5% 1/4W
R276	40-27-1272	FXD C FILM 270 OHM 5% 1/4W
R277	40-27-2472	FXD C FILM 4.7K OHM 5% 1/4W
R278	40-27-2472	FXD C FILM 4.7K OHM 5% 1/4W
R279	40-27-0472	FXD C FILM 47 OHM 5% 1/4W
R282	40-27-0472	FXD C FILM 47 OHM 5% 1/4W
R283	40-27-2122	FXD C FILM 1.2K OHM 5% 1/4W
R284	40-27-2682	FXD C FILM 6.8K OHM 5% 1/4W
R285	40-27-1222	FXD C FILM 220 OHM 5% 1/4W
R286	40-27-0222	FXD C FILM 22 OHM 5% 1/4W
R287	40-27-2222	FXD C FILM 2.2K OHM 5% 1/4W
R301	40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R302	40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R303	42-72-1470	FXD M FILM 470 OHM 1% 1/4W
R304	42-72-1470	FXD M FILM 470 OHM 1% 1/4W

REFERENCE DESIGNATOR		KIKUSUI PARTS NO.	DESCRIPTION
R305		40-27-1822	FXD C FILM 820 OHM 5% 1/4W
R306		40-27-1822	FXD C FILM 820 OHM 5% 1/4W
R307		40-27-1682	FXD C FILM 680 OHM 5% 1/4W
R308		40-27-0822	FXD C FILM 82 OHM 5% 1/4W
R309		40-27-0822	FXD C FILM 82 OHM 5% 1/4W
R310		40-27-1222	FXD C FILM 220 OHM 5% 1/4W
R311		40-27-1222	FXD C FILM 220 OHM 5% 1/4W
R312		40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R313		40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W
R314		40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R315		40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R316		40-27-3102	FXD C FILM 10K OHM 5% 1/4W
R318		40-27-3102	FXD C FILM 10K OHM 5% 1/4W
R319		40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R320		44-07-0020	FXD M GLAZE RESISTOR NETWORKS 10K OHM X4
R331		42-72-0910	FXD M FILM 91 OHM 1% 1/4W
R332		42-72-0910	FXD M FILM 91 OHM 1% 1/4W
R333		42-72-1470	FXD M FILM 470 OHM 1% 1/4W
R334		42-72-1470	FXD M FILM 470 OHM 1% 1/4W
R335		40-27-1822	FXD C FILM 820 OHM 5% 1/4W
R336		40-27-1682	FXD C FILM 680 OHM 5% 1/4W
R337		40-27-1682	FXD C FILM 680 OHM 5% 1/4W
R338		40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R339		40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R341	*	40-27-3332	FXD C FILM 33K OHM 5% 1/4W
R342		40-27-1222	FXD C FILM 220 OHM 5% 1/4W
R343		40-27-1222	FXD C FILM 220 OHM 5% 1/4W
R344		40-27-0222	FXD C FILM 22 OHM 5% 1/4W
R345		40-27-0222	FXD C FILM 22 OHM 5% 1/4W
R346		44-91-3330	FXD M OXIDE 33K OHM 5% 1W
R347		44-91-3330	FXD M OXIDE 33K OHM 5% 1W
R348		40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R349		40-27-8472	FXD C FILM 4.7 OHM 5% 1/4W
R350		40-27-8472	FXD C FILM 4.7 OHM 5% 1/4W
R351		40-27-2332	FXD C FILM 3.3K OHM 5% 1/4W
R352		40-37-3471	FXD C FILM 47K OHM 5% 1/2W
R353		40-37-3471	FXD C FILM 47K OHM 5% 1/2W
R354		40-27-2332	FXD C FILM 3.3K OHM 5% 1/4W
R355		40-27-8472	FXD C FILM 4.7 OHM 5% 1/4W
R356		40-27-8472	FXD C FILM 4.7 OHM 5% 1/4W
R357		40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R358		40-27-1332	FXD C FILM 330 OHM 5% 1/4W
R359		40-27-2102	FXD C FILM 1K OHM 5% 1/4W
R360		40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R361		40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R362		40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R363		40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R364		40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R365		40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R366		40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R367		40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R368	*	40-27-3102	FXD C FILM 10K OHM 5% 1/4W
R369		40-27-1272	FXD C FILM 270 OHM 5% 1/4W
R370		40-27-8472	FXD C FILM 4.7 OHM 5% 1/4W
R371		40-27-8472	FXD C FILM 4.7 OHM 5% 1/4W
R621		40-37-5221	FXD C FILM 2.2M OHM 5% 1/2W
R622		40-37-5221	FXD C FILM 2.2M OHM 5% 1/2W
R623		44-92-2270	FXD M OXIDE 2.7K OHM 5% 2W
R624		40-27-0102	FXD C FILM 10 OHM 5% 1/4W
R625		40-27-1102	FXD C FILM 100 OHM 5% 1/4W
R626		40-27-1222	FXD C FILM 220 OHM 5% 1/4W
R627		40-27-1562	FXD C FILM 560 OHM 5% 1/4W
R628		42-72-4120	FXD M FILM 120K OHM 1% 1/4W
R629		42-72-3100	FXD M FILM 10K OHM 1% 1/4W
R631		44-91-0010	FXD M OXIDE 1 OHM 5% 1W
R632		40-27-1102	FXD C FILM 100 OHM 5% 1/4W
R633		44-91-1100	FXD M OXIDE 100 OHM 5% 1W
R634		40-27-1102	FXD C FILM 100 OHM 5% 1/4W
R635		40-37-8222	FXD C FILM 2.2 OHM 5% 1/2W
R636		44-91-1100	FXD M OXIDE 100 OHM 5% 1W
R637		40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W
R638		42-72-3120	FXD M FILM 12K OHM 1% 1/4W
R639		42-72-3120	FXD M FILM 12K OHM 1% 1/4W
R640		40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W
R641		40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W
R642		42-72-2390	FXD M FILM 3.9K OHM 1% 1/4W
R643		42-72-2910	FXD M FILM 9.1K OHM 1% 1/4W

REFERENCE DESIGNATOR		KIKUSUI PARTS NO.	DESCRIPTION
R644	*	40-27-1152	FXD C FILM 150 OHM 5% 1/4W
R645		44-91-1100	FXD M OXIDE 100 OHM 5% 1W
R646		40-37-1101	FXD C FILM 100 OHM 5% 1/2W
R1623		44-92-2270	FXD M OXIDE 2.7K OHM 5% 2W
RV101		48-33-3200	VAR M FILM 20K OHM
RV102		48-33-1100	VAR M FILM 100 OHM
RV103		48-33-1500	VAR M FILM 500 OHM
RV105		48-33-3200	VAR M FILM 20K OHM
RV106		48-33-1100	VAR M FILM 100 OHM
RV107		48-33-2100	VAR M FILM 1K OHM
RV108		48-33-2200	VAR M FILM 2K OHM
RV109		48-33-1200	VAR M FILM 200 OHM
RV110		48-33-2100	VAR M FILM 1K OHM
RV112		48-33-3200	VAR M FILM 20K OHM
RV201		48-33-3200	VAR M FILM 20K OHM
RV202		48-33-1100	VAR M FILM 100 OHM
RV203		48-33-1500	VAR M FILM 500 OHM
RV205		48-33-3200	VAR M FILM 20K OHM
RV207		48-33-2100	VAR M FILM 1K OHM
RV209		48-33-1200	VAR M FILM 200 OHM
RV210		48-33-2100	VAR M FILM 1K OHM
RV212		48-33-3200	VAR M FILM 20K OHM
RV301		48-33-1500	VAR M FILM 500 OHM
RV302		48-33-2200	VAR M FILM 2K OHM
RV606		48-33-2100	VAR M FILM 1K OHM
C101		50-96-3590	FXD PLSTC FILM 0.022UF 20% 630V
C102		57-10-1191	VAR CER 3-10PF
C103		57-10-1181	VAR CER 3-6PF
C104		52-06-3165	FXD CER 33PF 10% 500V TYPE1
C105		57-10-1191	VAR CER 3-10PF
C106		57-10-1181	VAR CER 3-6PF
C107		52-06-2225	FXD CER 220PF 10% 50V TYPE1
C108		52-06-2225	FXD CER 220PF 10% 50V TYPE1
C111		50-87-0510	FXD PLSTC FILM 2200PF 10% 400V
C112		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2
C113		52-01-3345	FXD CER 1000PF 10% 500V TYPE2
C114		52-01-3345	FXD CER 1000PF 10% 500V TYPE2
C115		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2
C116		54-00-0311	FXD ELECT 10UF 50V
C117		52-06-3125	FXD CER 15PF 10% 500V TYPE1
C119		52-06-3102	FXD CER 10PF 10% 500V TYPE1
C120		52-06-3145	FXD CER 22PF 10% 500V TYPE1
C121		52-06-2225	FXD CER 220PF 10% 50V TYPE1
C122		52-06-2225	FXD CER 220PF 10% 50V TYPE1
C131		57-10-1203	VAR CER 5-20PF
C132		52-06-3051	FXD CER 5PF 10% 500V TYPE1
C137		52-06-3051	FXD CER 5PF 10% 500V TYPE1
C151		52-06-2304	FXD CER 68P 10% 50V TYPE1
C152		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2
C153		54-00-0311	FXD ELECT 10UF 50V
C171		57-10-1203	VAR CER 5-20PF
C172		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2
C173		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2
C174		52-06-3165	FXD CER 33PF 10% 500V TYPE1
C175		52-06-2225	FXD CER 100PF 10% 50V TYPE1
C176		52-06-3051	FXD CER 5PF 10% 500V TYPE1
C177		52-06-2215	FXD CER 82PF 10% 500V TYPE1
C178		52-06-2215	FXD CER 82PF 10% 500V TYPE1
C179		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2
C181		52-06-2225	FXD CER 100PF 10% 50V TYPE1
C200		52-03-3469	FXD CER 0.01UF +100-0% 500V TYPE2
C201		50-96-3590	FXD PLSTC FILM 0.022UF 20% 630V
C202		57-10-1191	VAR CER 3-10PF
C203		57-10-1181	VAR CER 3-6PF
C204		52-06-3165	FXD CER 33PF 10% 500V TYPE1
C205		57-10-1191	VAR CER 3-10PF
C206		57-10-1181	VAR CER 3-6PF
C207		52-06-2225	FXD CER 220PF 10% 50V TYPE1
C208		52-06-2225	FXD CER 220PF 10% 50V TYPE1
C211		50-87-0510	FXD PLSTC FILM 2200PF 10% 400V
C212		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2
C213		52-01-3345	FXD CER 1000PF 10% 500V TYPE2
C214		52-01-3345	FXD CER 1000PF 10% 500V TYPE2
C215		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2
C216		54-00-0311	FXD ELECT 10UF 50V

REFERENCE DESIGNATOR		KIKUSUI PARTS NO.	DESCRIPTION	
C217		52-06-3125	FXD CER 15PF 10% 500V TYPE1	
C219		52-06-3102	FXD CER 10PF 10% 500V TYPE1	
C220		52-06-3145	FXD CER 22PF 10% 500V TYPE1	
C221		52-06-2265	FXD CER 220PF 10% 50V TYPE1	
C222		52-06-2265	FXD CER 220PF 10% 50V TYPE1	
C231		57-10-1203	VAR CER 5-20PF	
C232		52-06-3051	FXD CER 5PF 10% 500V TYPE1	
C233		52-06-3051	FXD CER 5PF 10% 500V TYPE1	
C251		52-06-2204	FXD CER 68P 10% 50V TYPE1	
C252		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C271		57-10-1223	VAR CER 8-50PF	
C272		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C273		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C274		52-06-3165	FXD CER 33PF 10% 500V TYPE1	
C275		52-06-2225	FXD CER 100PF 10% 50V TYPE1	
C277		52-06-2215	FXD CER 82PF 10% 500V TYPE1	
C278		52-06-2215	FXD CER 82PF 10% 500V TYPE1	
C279		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C281		52-06-2225	FXD CER 100PF 10% 50V TYPE1	
C282		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C301		54-00-0121	FXD ELECT 100UF 25V	
C302		54-00-0121	FXD ELECT 100UF 25V	
C303		52-01-3345	FXD CER 1000PF 10% 500V TYPE2	
C305		—	—	
C306		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C308		52-06-3155	FXD CER 27PF 10% 500V TYPE1	
C309		52-06-3155	FXD CER 27PF 10% 500V TYPE1	
C331		57-10-1203	VAR CER 5-20PF	
C332		52-06-3051	FXD CER 5PF 10% 500V TYPE1	
C333		50-45-0500	FXD PLSTC FILM 0.01MF 5% 50V	
C334		50-45-0500	FXD PLSTC FILM 0.01MF 5% 50V	
C335		52-96-1140	FXD COMP 0.47PF 10% 500V	
C336		52-96-1140	FXD COMP 0.47PF 10% 500V	
C337		50-77-3500	FXD PLSTC FILM 0.047UF 20% 250V	
C338		50-77-3500	FXD PLSTC FILM 0.047UF 20% 250V	
C339		50-96-3590	FXD PLSTC FILM 0.022UF 20% 630V	
C341		50-96-3590	FXD PLSTC FILM 0.022UF 20% 630V	
C342		54-60-1550	FXD ELECT 1UF 160V	
C343		52-05-1498	FXD CER 0.1UF +80-20% 25V TYPE2	
C344		50-67-0050	FXD PLSTC FILM 0.047UF 10% 100V	
C345	*	52-06-3125	FXD CER 15PF 10% 500V TYPE1	
C346	*	52-06-3125	FXD CER 15PF 10% 500V TYPE1	
C347		54-00-0311	FXD ELECT 10UF 50V	
C348		54-00-0311	FXD ELECT 10UF 50V	
C349		52-06-3102	FXD CER 10PF 10% 500V TYPE1	
C351		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C352		52-05-2468	FXD CER 0.01UF +80-20% 50V TYPE2	
C353		52-06-3145	FXD CER 22PF 10% 500V TYPE1	
C354		52-06-3145	FXD CER 22PF 10% 500V TYPE1	
C621		50-67-0040	FXD PLSTC FILM 0.022UF 10% 100V	
C622		50-67-0040	FXD PLSTC FILM 0.022UF 10% 100V	
C623		54-60-1620	FXD ELECT 47UF 200V	
C624		54-70-1020	FXD ELECT 2.2UF 250V	
C625		54-60-1550	FXD ELECT 1UF 160V	
C626		54-00-0231	FXD ELECT 1000UF 35V	
C627		54-00-0231	FXD ELECT 1000UF 35V	
C628		54-00-0114	FXD ELECT 47UF 25V	
S101		80-98-0580	SW ROTARY WITH RV VOLT/DIV	ALPS S21P2YC
S102		82-70-8231	LEVER SWITCH	ALPS SLR823-1
S201		80-98-0580	SW ROTARY WITH RV VOLT/DIV	ALPS S21P2YC
S202		82-70-8231	LEVER SWITCH	ALPS SLR823-1
S301		82-70-8243	LEVER SWITCH	ALPS SLR824-3
A2 ASSEMBLY				
CR401		32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR402		32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR403		32-30-0860	DIODE VR=30V IO=30MA	HITACHI 1SS86
CR404		32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR452		32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR453		32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR454		32-92-0033	ZENER VZ=3.2-3.4V	HITACHI HZ3C-2
CR455		32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR456		32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR457		32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR458		32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR459		32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	
CR460	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR461	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR462	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR463	32-30-0830	DIODE VR=30V IO=30MA	HITACHI 1SS86
CR464	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR465	32-92-0026	ZENER VZ=5.5-5.8V P=0.4W	NEC RD5.6J
CR466	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR469	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR501	32-30-0830	DIODE VR=30V IO=30MA	HITACHI 1SS86
CR502	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR503	32-30-0830	DIODE VR=250V IO=200MA	HITACHI 1SS83
CR504	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR651	32-92-0026	ZENER VZ=5.5-5.8V P=0.4W	NEC RD5.6J
CR652	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR653	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR654	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR657	32-30-0830	DIODE VR=250V IO=200MA	HITACHI 1SS83
CR658	32-90-1870	DIODE VR=2KV FAST RECOVERY	HITACHI ERB26-20
CR659	32-30-0830	DIODE VR=250V IO=200MA	HITACHI 1SS83
CR660	32-30-0830	DIODE VR=250V IO=200MA	HITACHI 1SS83
CR661	32-30-0830	DIODE VR=250V IO=200MA	HITACHI 1SS83
CR662	32-30-0830	DIODE VR=250V IO=200MA	HITACHI 1SS83
CR663	32-30-0830	DIODE VR=250V IO=200MA	HITACHI 1SS83
CR664	32-30-0830	DIODE VR=250V IO=200MA	HITACHI 1SS83
CR665	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR666	32-92-0022	ZENER VZ=2.1-2.3V	HITACHI HZ2B-3
CR667	32-92-0022	ZENER VZ=2.1-2.3V	HITACHI HZ2B-3
CR668	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR669	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR670	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR681	32-90-1951	DIODE VR=6KV FAST RECOVERY	SANKEN GHV-06SSN
CR682	32-90-1951	DIODE VR=6KV FAST RECOVERY	SANKEN GHV-06SSN
CR683	32-90-1951	DIODE VR=6KV FAST RECOVERY	SANKEN GHV-06SSN
CR684	32-90-1951	DIODE VR=6KV FAST RECOVERY	SANKEN GHV-06SSN
CR685	32-90-1951	DIODE VR=6KV FAST RECOVERY	SANKEN GHV-06SSN
CR686	32-90-1951	DIODE VR=6KV FAST RECOVERY	SANKEN GHV-06SSN
CR687	32-90-1951	DIODE VR=6KV FAST RECOVERY	SANKEN GHV-06SSN
CR701	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR702	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR703	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR704	32-30-0830	DIODE VR=30V IO=30MA	HITACHI 1SS86
CR705	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR706	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR707	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR708	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
CR709	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588

Q401	30-10-8381	TR SI PNP	MATSUSHITA 2SA838-B
Q402	30-10-8381	TR SI PNP	MATSUSHITA 2SA838-B
Q403	31-20-1070	FET	SONY 2SK107-3
Q404	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q405	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q406	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q407	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q408	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q409	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q410	31-20-1171	FET	TOSHIBA 2SK117-BL
Q411	30-11-8151	TR SI PNP	TOSHIBA 2SA1015-Y
Q412	30-10-8381	TR SI PNP	MATSUSHITA 2SA838-B
Q413	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q415	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q416	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q417	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q418	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q419	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q420	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q421	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q422	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q424	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q425	30-31-8431	TR SI NPN	NEC 2SC1843-E
Q426	31-20-1171	FET	TOSHIBA 2SK117-BL
Q427	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q428	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q429	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q430	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q431	30-30-9451	TR SI NPN	NEC 2SC945-Q

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	
Q501	30-11-0151	TR SI PNP	TOSHIBA 2SA1015-Y
Q502	30-11-0151	TR SI PNP	TOSHIBA 2SA1015-Y
Q503	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q504	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q505	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q506	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q507	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q508	30-10-8381	TR SI PNP	MATSUSHITA 2SA838-B
Q509	30-20-6481	TR SI PNP	HITACHI 2SB648A
Q510	30-40-6681	TR SI NPN	HITACHI 2SD668A-C
Q511	30-40-6681	TR SI NPN	HITACHI 2SD668A-C
Q512	30-20-6481	TR SI PNP	HITACHI 2SB648A
Q651	30-40-8802	TR SI NPN	NEC 2SD880-Y
Q652	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q654	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q655	30-31-9071	TR SI NPN	HITACHI 2SC1907
Q656	30-32-3710	TR SI NPN	NEC 2SC2371-L
Q657	30-32-3710	TR SI NPN	NEC 2SC2371-L
Q658	30-32-3710	TR SI NPN	NEC 2SC2371-L
Q659	30-32-3710	TR SI NPN	NEC 2SC2371-L
Q660	31-20-1171	FET	TOSHIBA 2SK117-BL
Q702	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q703	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q704	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q705	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q706	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q707	30-30-9451	TR SI NPN	NEC 2SC945-Q
Q708	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q709	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q710	31-20-1171	FET	TOSHIBA 2SK117-BL
Q711	30-31-8431	TR SI NPN	NEC 2SC1843-E
Q712	30-10-8441	TR SI PNP	HITACHI 2SA844-D
Q713	30-10-8441	TR SI PNP	HITACHI 2SA844-D
U401	35-70-0004	QUAD 2-INPUT POSI-NAND	T.I SN74ALS00N
U402	35-70-1121	DUAL J-K F-F	T.I SN74LS112N
U403	34-00-0215	J-FET INPUT OPEAMP	N.S LF13741N
U404	34-69-0030	TRIPLE 2-CHANNEL MULTIPLEXER	TOSHIBA TC4053BP
U651	34-00-0215	J-FET INPUT OPEAMP	N.S LF13741N
U701	35-70-1121	DUAL J-K F-F	T.I SN74LS112N
U702	35-70-0001	QUAD 2-INPUT POSI-NAND	T.I SN74LS00N
U703	34-00-0215	J-FET INPUT OPEAMP	N.S LF13741N
R401	40-27-0472	FXD C FILM 47 OHM 5% 1/4W	
R402	42-72-2100	FXD M FILM 1K OHM 1% 1/4W	
R403	40-27-2222	FXD C FILM 2.2K OHM 5% 1/4W	
R404	40-27-2122	FXD C FILM 1.2K OHM 5% 1/4W	
R405	40-27-2222	FXD C FILM 2.2K OHM 5% 1/4W	
R406	40-27-2332	FXD C FILM 3.3K OHM 5% 1/4W	
R407	40-27-0472	FXD C FILM 47 OHM 5% 1/4W	
R408	40-27-3472	FXD C FILM 47K OHM 5% 1/4W	
R409	42-74-5100	FXD M FILM 1M OHM 1% 1/2W	
R410	40-27-3102	FXD C FILM 10K OHM 5% 1/4W	
R411	40-27-2152	FXD C FILM 1.5K OHM 5% 1/4W	
R412	40-27-1332	FXD C FILM 330 OHM 5% 1/4W	
R413	40-27-1562	FXD C FILM 560 OHM 5% 1/4W	
R414	40-27-0682	FXD C FILM 68 OHM 5% 1/4W	
R415	40-27-2392	FXD C FILM 3.9K OHM 5% 1/4W	
R416	40-27-2392	FXD C FILM 3.9K OHM 5% 1/4W	
R417	40-27-1682	FXD C FILM 680 OHM 5% 1/4W	
R418	40-27-1682	FXD C FILM 680 OHM 5% 1/4W	
R419	40-27-1682	FXD C FILM 680 OHM 5% 1/4W	
R420	40-27-1682	FXD C FILM 680 OHM 5% 1/4W	
R421	40-27-4102	FXD C FILM 100K OHM 5% 1/4W	
R422	40-27-4102	FXD C FILM 100K OHM 5% 1/4W	
R423	40-27-2222	FXD C FILM 2.2K OHM 5% 1/4W	
R424	40-27-3222	FXD C FILM 22K OHM 5% 1/4W	
R425	40-27-3102	FXD C FILM 10K OHM 5% 1/4W	
R427	40-27-3102	FXD C FILM 10K OHM 5% 1/4W	
R428	40-27-0332	FXD C FILM 33 OHM 5% 1/4W	
R429	40-27-1562	FXD C FILM 560 OHM 5% 1/4W	
R431	40-27-3102	FXD C FILM 10K OHM 5% 1/4W	
R432	40-27-2102	FXD C FILM 1K OHM 5% 1/4W	
R433	40-27-4472	FXD C FILM 470K OHM 5% 1/4W	
R434	40-27-4472	FXD C FILM 470K OHM 5% 1/4W	
R435	40-27-1392	FXD C FILM 390 OHM 5% 1/4W	
R436	40-27-1102	FXD C FILM 100 OHM 5% 1/4W	

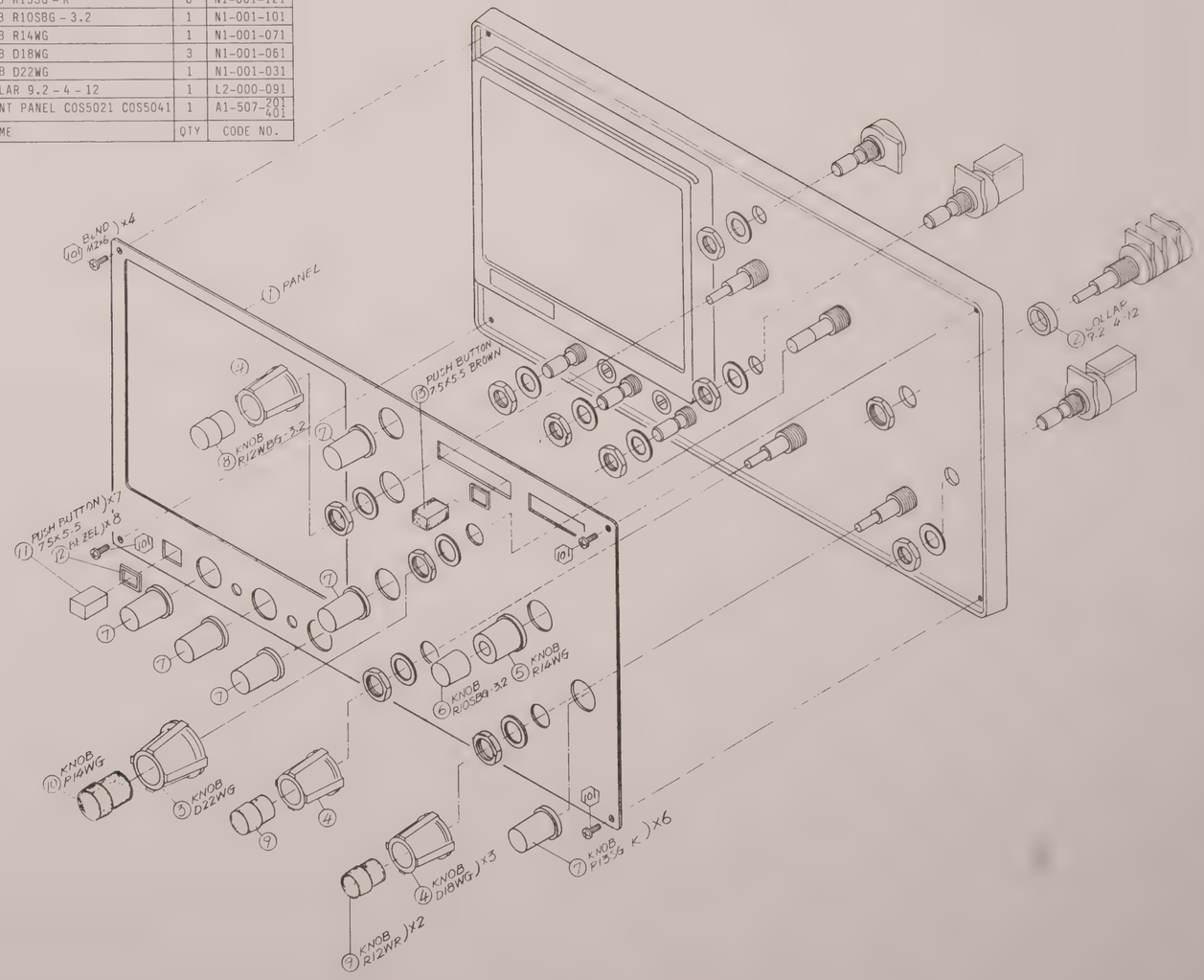
REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	
R437	40-27-1272	FXD C FILM 270 OHM 5% 1/4W	
R438	40-27-1222	FXD C FILM 220 OHM 5% 1/4W	
R439	40-27-0000	JUMPER PARTS	
R440	40-27-2222	FXD C FILM 2.2K OHM 5% 1/4W	
R441	40-27-2222	FXD C FILM 2.2K OHM 5% 1/4W	
R442	40-27-0472	FXD C FILM 4.7 OHM 5% 1/4W	
R443	40-27-3472	FXD C FILM 47K OHM 5% 1/4W	
R451	--	--	
R452	40-27-1332	FXD C FILM 330 OHM 5% 1/4W	
R453	40-27-0220	FXD C FILM 22 OHM 5% 1/4W	
R454	40-27-3472	FXD C FILM 47K OHM 5% 1/4W	
R455	40-27-2182	FXD C FILM 1.8K OHM 5% 1/4W	
R456	40-27-3102	FXD C FILM 10K OHM 5% 1/4W	
R458	40-27-3102	FXD C FILM 10K OHM 5% 1/4W	
R459	40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W	
R460	40-27-3472	FXD C FILM 47K OHM 5% 1/4W	
R461	42-72-3220	FXD M FILM 22K OHM 1% 1/4W	
R462	42-72-3330	FXD M FILM 33K OHM 1% 1/4W	
R463	40-27-2272	FXD C FILM 2.7K OHM 5% 1/4W	
R466	40-27-2102	FXD C FILM 1K OHM 5% 1/4W	
R467	40-27-0472	FXD C FILM 47 OHM 5% 1/4W	
R468	40-27-2222	FXD C FILM 2.2K OHM 5% 1/4W	
R469	40-27-3102	FXD C FILM 10K OHM 5% 1/4W	
R470	40-27-1822	FXD C FILM 820 OHM 5% 1/4W	
R471	40-27-3562	FXD C FILM 56K OHM 5% 1/4W	
R472	40-27-2222	FXD C FILM 2.2K OHM 5% 1/4W	
R473	40-27-2122	FXD C FILM 1.2K OHM 5% 1/4W	
R474	--	--	
R475	40-27-2392	FXD C FILM 3.9K OHM 5% 1/4W	
R476	40-27-3182	FXD C FILM 18K OHM 5% 1/4W	
R477	40-27-1222	FXD C FILM 220 OHM 5% 1/4W	
R478	42-72-2220	FXD M FILM 2.2K OHM 1% 1/4W	
R479	40-27-4472	FXD C FILM 470K OHM 5% 1/4W	
R480	40-27-3102	FXD C FILM 10K OHM 5% 1/4W	
R481	40-27-3332	FXD C FILM 33K OHM 5% 1/4W	
R482	40-27-3102	FXD C FILM 10K OHM 5% 1/4W	
R483	40-27-2472	FXD C FILM 4.7K OHM 5% 1/4W	
R484	42-72-2160	FXD M FILM 1.6K OHM 1% 1/4W	
R485	40-27-4102	FXD C FILM 100K OHM 5% 1/4W	
R486	40-27-2332	FXD C FILM 3.3K OHM 5% 1/4W	
R487	40-27-0102	FXD C FILM 10 OHM 5% 1/4W	
R488	40-27-0102	FXD C FILM 10 OHM 5% 1/4W	
R489	40-27-0102	FXD C FILM 10 OHM 5% 1/4W	
R491	42-24-0231	FXD M GLAZE 5M OHM 1% 0.31W	
R492	42-74-5100	FXD M FILM 1M OHM 1% 1/2W	
R493	44-04-0010	FXD M GLAZE R-NETWORK	KIKUSUI S8109011
R494	42-72-2390	FXD M FILM 3.9K OHM 1% 1/4W	
R495	42-72-1470	FXD M FILM 470 OHM 1% 1/4W	
R496	40-27-3102	FXD C FILM 10K OHM 5% 1/4W	
R498	40-27-1562	FXD C FILM 560 OHM 5% 1/4W	
R499	40-27-1102	FXD C FILM 100 OHM 5% 1/4W	
R501	40-27-2682	FXD C FILM 6.8K OHM 5% 1/4W	
R502	40-27-1472	FXD C FILM 470 OHM 5% 1/4W	
R503	42-72-0560	FXD M FILM 56 OHM 1% 1/4W	
R504	40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W	
R505	40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W	
R506	40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W	
R507	40-27-2562	FXD C FILM 5.6K OHM 5% 1/4W	
R508	42-72-2100	FXD M FILM 1K OHM 1% 1/4W	
R509	42-72-2100	FXD M FILM 1K OHM 1% 1/4W	
R510	42-72-2100	FXD M FILM 1K OHM 1% 1/4W	
R511	42-72-1560	FXD M FILM 560 OHM 1% 1/4W	
R512	40-27-1332	FXD C FILM 330 OHM 5% 1/4W	
R513	40-27-1332	FXD C FILM 330 OHM 5% 1/4W	
R514	40-27-3122	FXD C FILM 12K OHM 5% 1/4W	
R515	40-27-4102	FXD C FILM 100K OHM 5% 1/4W	
R516	40-27-2222	FXD C FILM 2.2K OHM 5% 1/4W	
R517	40-27-2222	FXD C FILM 2.2K OHM 5% 1/4W	
R518	42-72-4100	FXD M FILM 100K OHM 1% 1/4W	
R519	42-72-4100	FXD M FILM 100K OHM 1% 1/4W	
R520	40-27-4102	FXD C FILM 100K OHM 5% 1/4W	
R521	40-27-4102	FXD C FILM 100K OHM 5% 1/4W	
R522	40-27-2152	FXD C FILM 1.5K OHM 5% 1/4W	
R523	40-27-1332	FXD C FILM 330 OHM 5% 1/4W	
R524	40-27-2152	FXD C FILM 1.5K OHM 5% 1/4W	
R525	40-27-1332	FXD C FILM 330 OHM 5% 1/4W	
R526	40-27-0472	FXD C FILM 47 OHM 5% 1/4W	

REFERENCE DESIGNATOR		KIKUSUI PARTS NO.	DESCRIPTION		
R527		40-27-0472	FXD C FILM	47 OHM 5% 1/4W	
R528	*	-- --			
R651		42-72-2820	FXD M FILM	8.2K OHM 1% 1/4W	
R652		42-72-3120	FXD M FILM	12K OHM 1% 1/4W	
R653	*	40-27-4122	FXD C FILM	120K OHM 5% 1/4W	
R654		42-72-4100	FXD M FILM	100K OHM 1% 1/4W	
R655		40-27-2102	FXD C FILM	1K OHM 5% 1/4W	
R657		44-91-0010	FXD M OXIDE	1 OHM 5% 1W	
R658		40-27-2472	FXD C FILM	4.7K OHM 5% 1/4W	
R659		40-27-1472	FXD C FILM	470 OHM 5% 1/4W	
R661		42-44-0310	FXD M GLAZE	6.8M OHM 1% 1.6W	
R662		42-44-0300	FXD M GLAZE	10M OHM 1% 2.5W	
R663		40-27-2102	FXD C FILM	1K OHM 5% 1/4W	
R664		40-27-3102	FXD C FILM	10K OHM 5% 1/4W	
R665		40-37-5221	FXD C FILM	2.2M OHM 5% 1/2W	
R666		40-37-6101	FXD C FILM	10M OHM 5% 1/2W	
R667		40-37-6101	FXD C FILM	10M OHM 5% 1/2W	
R668		40-27-2332	FXD C FILM	3.3K OHM 5% 1/4W	
R669		40-37-5151	FXD C FILM	1.5M OHM 5% 1/2W	
R670	*	40-27-2272	FXD C FILM	2.7K OHM 5% 1/4W	
R671		40-27-4102	FXD C FILM	100K OHM 5% 1/4W	
R673		40-27-3102	FXD C FILM	10K OHM 5% 1/4W	
R674		40-37-6101	FXD C FILM	10M OHM 5% 1/2W	
R675		40-37-6101	FXD C FILM	10M OHM 5% 1/2W	
R676		40-37-5151	FXD C FILM	1.5M OHM 5% 1/2W	
R677		40-27-1102	FXD C FILM	100 OHM 5% 1/4W	
R678		40-27-1102	FXD C FILM	100 OHM 5% 1/4W	
R679		40-27-1102	FXD C FILM	100 OHM 5% 1/4W	
R680		40-27-4473	FXD C FILM	470K OHM 5% 1/4W	
R681		40-27-2182	FXD C FILM	1.8K OHM 5% 1/4W	
R683		40-27-2332	FXD C FILM	3.3K OHM 5% 1/4W	
R684		40-27-2222	FXD C FILM	2.2K OHM 5% 1/4W	
R685		40-27-1102	FXD C FILM	100 OHM 5% 1/4W	
R686		40-27-1222	FXD C FILM	220 OHM 5% 1/4W	
R687		40-27-2562	FXD C FILM	5.6K OHM 5% 1/4W	
R688		40-27-1332	FXD C FILM	330 OHM 5% 1/4W	
R689		40-27-2472	FXD C FILM	4.7K OHM 5% 1/4W	
R690		40-37-3471	FXD C FILM	470 OHM 5% 1/2W	
R691		40-37-3471	FXD C FILM	470 OHM 5% 1/2W	
R692		40-37-3471	FXD C FILM	470 OHM 5% 1/2W	
R693		40-27-1681	FXD C FILM	680 OHM 5% 1/4W	
R694		40-27-1680	FXD C FILM	680 OHM 5% 1/4W	
R695		40-37-3471	FXD C FILM	470 OHM 5% 1/2W	
R696		40-27-1102	FXD C FILM	100 OHM 5% 1/4W	
R697		40-27-4102	FXD C FILM	1000 OHM 5% 1/4W	
R698	*	40-27-3492	FXD C FILM	49K OHM 5% 1/4W	
R699		40-27-3562	FXD C FILM	56K OHM 5% 1/4W	
R702		40-27-2110	FXD C FILM	11 OHM 5% 1/4W	
R703		40-27-1472	FXD C FILM	470 OHM 5% 1/4W	
R704		40-27-2152	FXD C FILM	1.5K OHM 5% 1/4W	
R705		40-27-2110	FXD C FILM	11 OHM 5% 1/4W	
R706		40-27-2392	FXD C FILM	3.9K OHM 5% 1/4W	
R707		40-27-3103	FXD C FILM	10K OHM 5% 1/4W	
R708		40-27-3103	FXD C FILM	10K OHM 5% 1/4W	
R709		40-27-3563	FXD C FILM	56K OHM 5% 1/4W	
R711		40-27-2110	FXD C FILM	11 OHM 5% 1/4W	
R712		40-27-1470	FXD C FILM	47 OHM 5% 1/4W	
R713		40-27-3103	FXD C FILM	10K OHM 5% 1/4W	
R714		42-72-1332	FXD M FILM	33K OHM 1% 1/4W	
R715		42-72-2230	FXD M FILM	22K OHM 1% 1/4W	
R716		40-27-2122	FXD C FILM	1.2K OHM 5% 1/4W	
R717		40-27-3183	FXD C FILM	18K OHM 5% 1/4W	
R718		40-27-2392	FXD C FILM	3.9K OHM 5% 1/4W	
R719		40-27-1221	FXD C FILM	220 OHM 5% 1/4W	
R720		42-72-2100	FXD M FILM	1K OHM 1% 1/4W	
R721		42-72-2220	FXD M FILM	2.2K OHM 1% 1/4W	
R722		40-27-2562	FXD C FILM	5.6K OHM 5% 1/4W	
R723		40-27-2562	FXD C FILM	5.6K OHM 5% 1/4W	
R724		44-25-0000	FXD M GLAZE	R-NETWORK	KIKUSUI S8109021
R725		40-27-0102	FXD C FILM	10 OHM 5% 1/4W	
R730		40-27-2182	FXD C FILM	1.8K OHM 5% 1/4W	
R1401		40-27-2102	FXD C FILM	1K OHM 5% 1/4W	
R1403		40-27-2102	FXD C FILM	1K OHM 5% 1/4W	
R1404		40-27-4472	FXD C FILM	470K OHM 5% 1/4W	
R1405		40-27-2102	FXD C FILM	1K OHM 5% 1/4W	
R1651		-- --			
R1652		40-27-3152	FXD C FILM	15K OHM 5% 1/4W	

REFERENCE DESIGNATOR	KIKUSUI PARTS NO.	DESCRIPTION	
CR451	32-11-5880	DIODE VR=30V IO=120MA	TOSHIBA 1S1588
R101	40-27-0222	FXD C FILM 22 OHM 5% 1/4W	
R201	40-27-0220	FXD C FILM 22 OHM 5% 1/4W	
R405	40-27-9102	FXD C FILM 9.2K OHM 5% 1/4W	
R407	40-27-3103	FXD C FILM 10K OHM 5% 1/4W	
R711	44-07-0020	FXD M GLAZE RESISTOR NETWORKS	10K OHM X4
R1101	40-27-0562	FXD C FILM 56 OHM 5% 1/4W	
RV111	45-01-0700	VAR C COMP 10K OHM WITH SW	
RV211	45-01-0700	VAR C COMP 10K OHM WITH SW	
RV401	45-01-0650	VAR C COMP 10K/100K OHM B	
RV501	45-35-3103	VAR C COMP 10K OHM	
C110	52-06-2225	FXD CER 100PF 10% 50V TYPE1	
C210	52-06-2225	FXD CER 100PF 10% 50V TYPE1	
C453	52-01-3340	FXD CER 1000PF 10% 500V TYPE2	
C454	52-06-1498	FXD CER 0.1UF +80-20% 25V TYPE2	
C601	52-77-1000	FXD CER 100PF 250VAC	
C602	52-77-1000	FXD CER 100PF 250VAC	
DL501	91-90-0003	DELAY LINE 1.3M Z=186 OHM	
S404	81-03-0270	PUSH SWITCH	ALPS SUE30
S702	81-04-0260	PUSH SWITCH	ALPS SUE40
S1201	81-01-0270	PUSH SWITCH	ALPS SDGSP-E
T601	60-44-0110	POWER TRANS	KIKUSUI S820041
V501	21-46-0604	CRT	MATSUSHITA 150BYB31

NO.	NAME	QTY	CODE NO.
14			
13	PUSH BUTTON 7.5× 5.5 BRN	1	P2-000-371
12	BEZEL FOR PUSH BUTTON	8	P2-000-331
11	PUSH BUTTON 7.5 ×5.5	7	P2-000-321
10	KNOB R14WR	1	N2-000-061
9	KNOB R12WR - 2.5	2	N2-000-051
8	KNOB R12WBG - 2.5	1	N1-001-131
7	KNOB R13SG - K	6	N1-001-121
6	KNOB R10SBG - 3.2	1	N1-001-101
5	KNOB R14WG	1	N1-001-071
4	KNOB D18WG	3	N1-001-061
3	KNOB D22WG	1	N1-001-031
2	COLLAR 9.2 - 4 - 12	1	L2-000-091
1	FRONT PANEL COS5021 COS5041	1	A1-507-201 401

NO.	NAME	QTY	CODE NO.
105			
104			
103			
102			
101	BIND M2×8 P-N1	4	M2-000-301

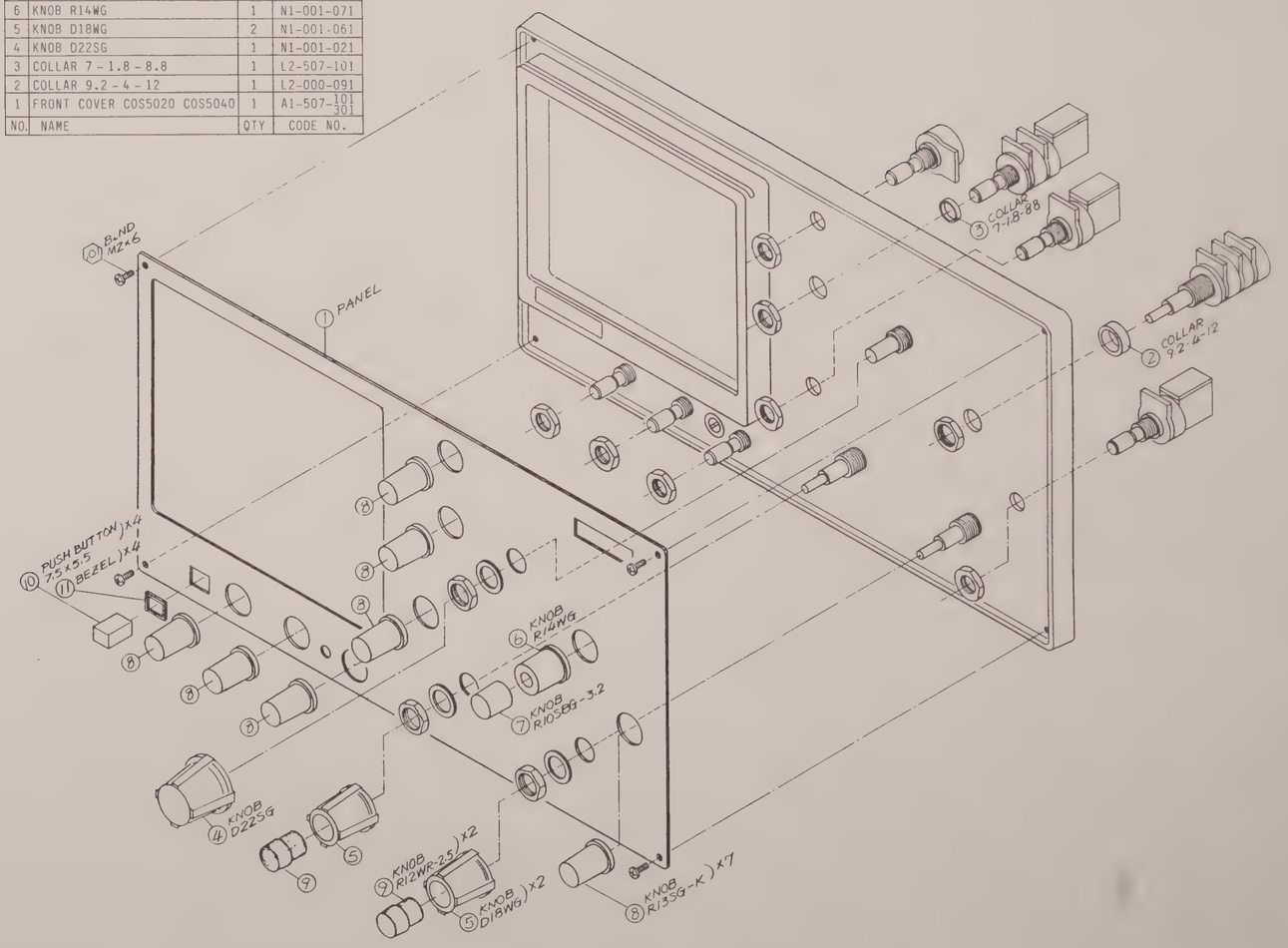


FRONT PANEL ASSEMBLY

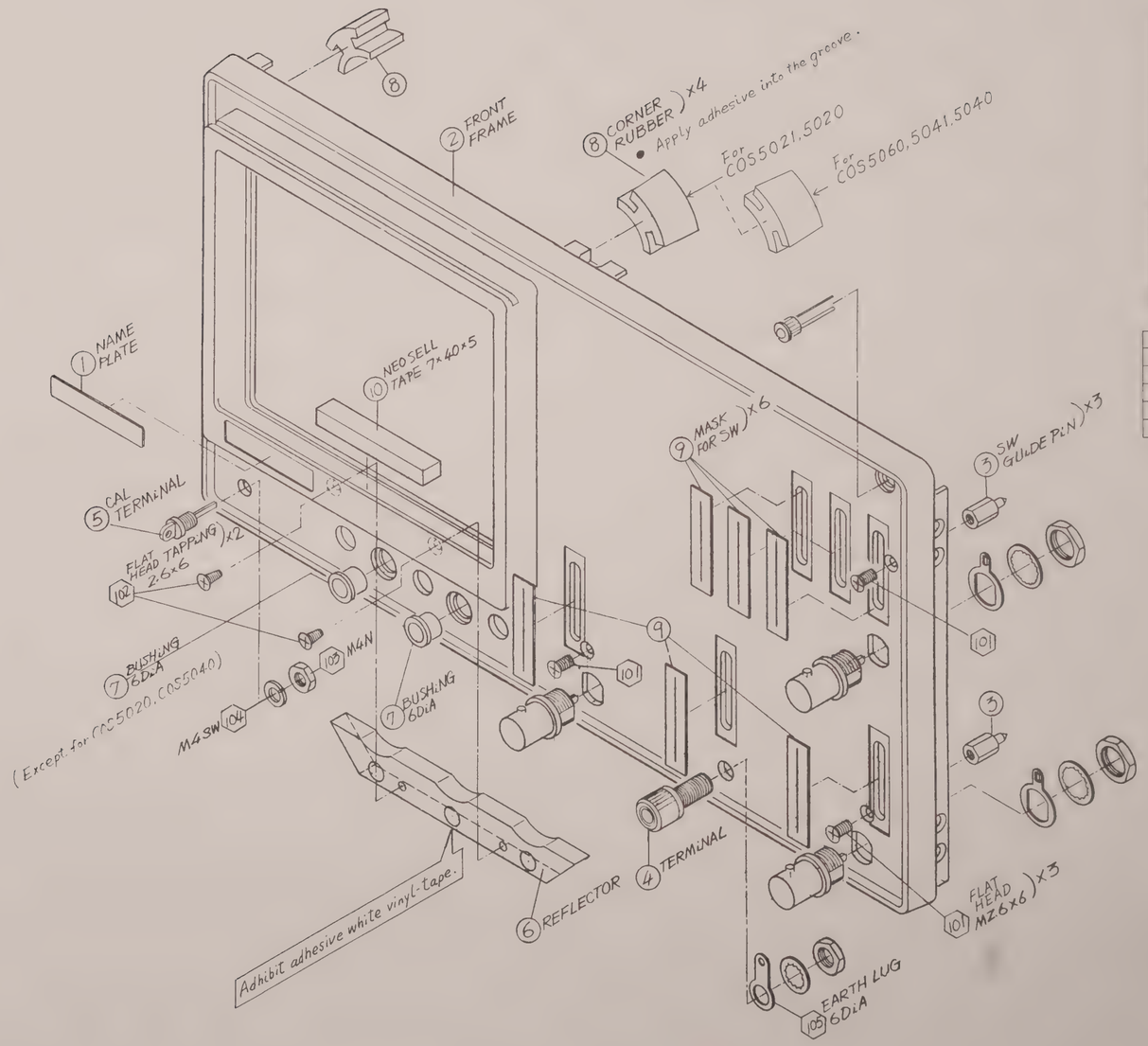
316097

NO.	NAME	QTY	CODE NO.
14			
13			
12			
11	BEZEL FOR PUSH BUTTON	4	P2-000-331
10	PUSH BUTTON 7.5×5.5	4	P2-000-321
9	KNOB R12WR-2.5	2	N2-000-051
8	KNOB R13SG-K	7	N1-001-121
7	KNOB R10SBG-3.2	1	N1-001-101
6	KNOB R14WG	1	N1-001-071
5	KNOB D18WG	2	N1-001-061
4	KNOB D22SG	1	N1-001-021
3	COLLAR 7-1.8-8.8	1	L2-507-101
2	COLLAR 9.2-4-12	1	L2-000-091
1	FRONT COVER COS5020 COS5040	1	A1-507-101 301

NO.	NAME	QTY	CODE NO.
105			
104			
103			
102			
101	FIND M2×6 B-NI	4	MS [illegible]



FRONT PANEL ASSEMBLY

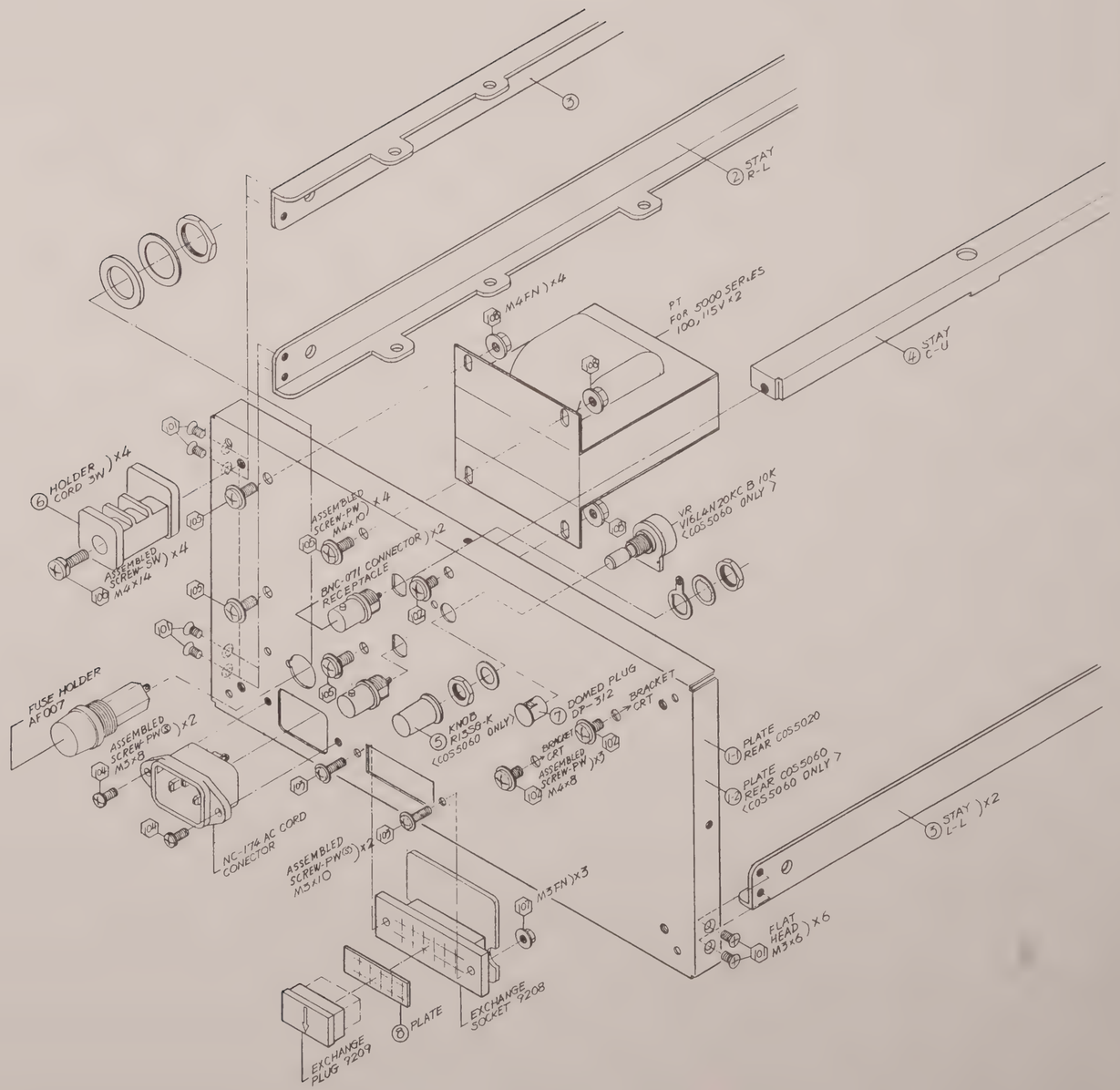


15			
14			
13			
12			
11			
10	RUBBER TAPE 7×40×5	1	[illegible]
9	MASK FOR SW	6	[illegible]
8	CORNER RUBBER FOR CRT	4	[illegible]
7	SNAP BUSHING 6DIA	1+(1)	[illegible]
6	REFLECTOR	1	P3-507-101
5	CAL TERMINAL	1	P2-000-291
4	TERMINAL GND SHORT	1	L4-000-021
3	SW GUIDE PIN	3	L3-506-702
2	FRONT FRAME	1	B9-050-151
1	NAME PLATE KIKUSUI	1	A8-000-621
NO.	NAME	QTY	CODE NO.

105	EARTH LUG 6DIA	1	M6-000-151
104	SPRING WASHER M4SW	1	M5-011-041
103	NUT M4N	2	M4-011-041
102	FLAT HEAD SCREW TAPPING 2.6×6	2	M2-001-401
101	FLAT HEAD SCREW M2.6×6	8	M2-001-041
NO.	NAME	QTY	CODE NO.

FRONT FRAME ASSEMBLY
(COMMON DRAWING)

316099



NO.	NAME	QTY	CODE NO.
110			
109	ASSEMBLED SCREW-PW M3×6 B-NI	1	M3-000-011
108	FLANGE NUT M4FN	4	M4-010-031
107	FLANGE NUT M3FN	3	M4-010-021
106	ASSEMBLED SCREW-SW M4×14	4	M3-011-101
105	ASSEMBLED SCREW-PW M4×10 B-NI	4	M3-000-061
104	ASSEMBLED SCREW-PW(S) M3×8 B-NI	2	M3-000-041
103	ASSEMBLED SCREW-PW(S) M3×10 B-NI	2	M3-000-051
102	ASSEMBLED SCREW-PW M4×8 B-NI	1	M3-000-031
101	FLAT HEAD SCREW M3×6	6	M3-001-011
NO.	NAME	QTY	CODE NO.

CO55020,5021,5040,5041

NO.	NAME	QTY	CODE NO.
7	DOMED PLUG DP-312	1	P4-050-081
1-5	REAR PLATE CO55020	1	B6-507-101
NO.	NAME	QTY	CODE NO.

FOR CO55060 ONLY

NO.	NAME	QTY	CODE NO.
5	ROUND KNOB R13SG-K	1	N1-001-121
1-5	REAR PLATE CO55060	1	B6-507-501
NO.	NAME	QTY	CODE NO.

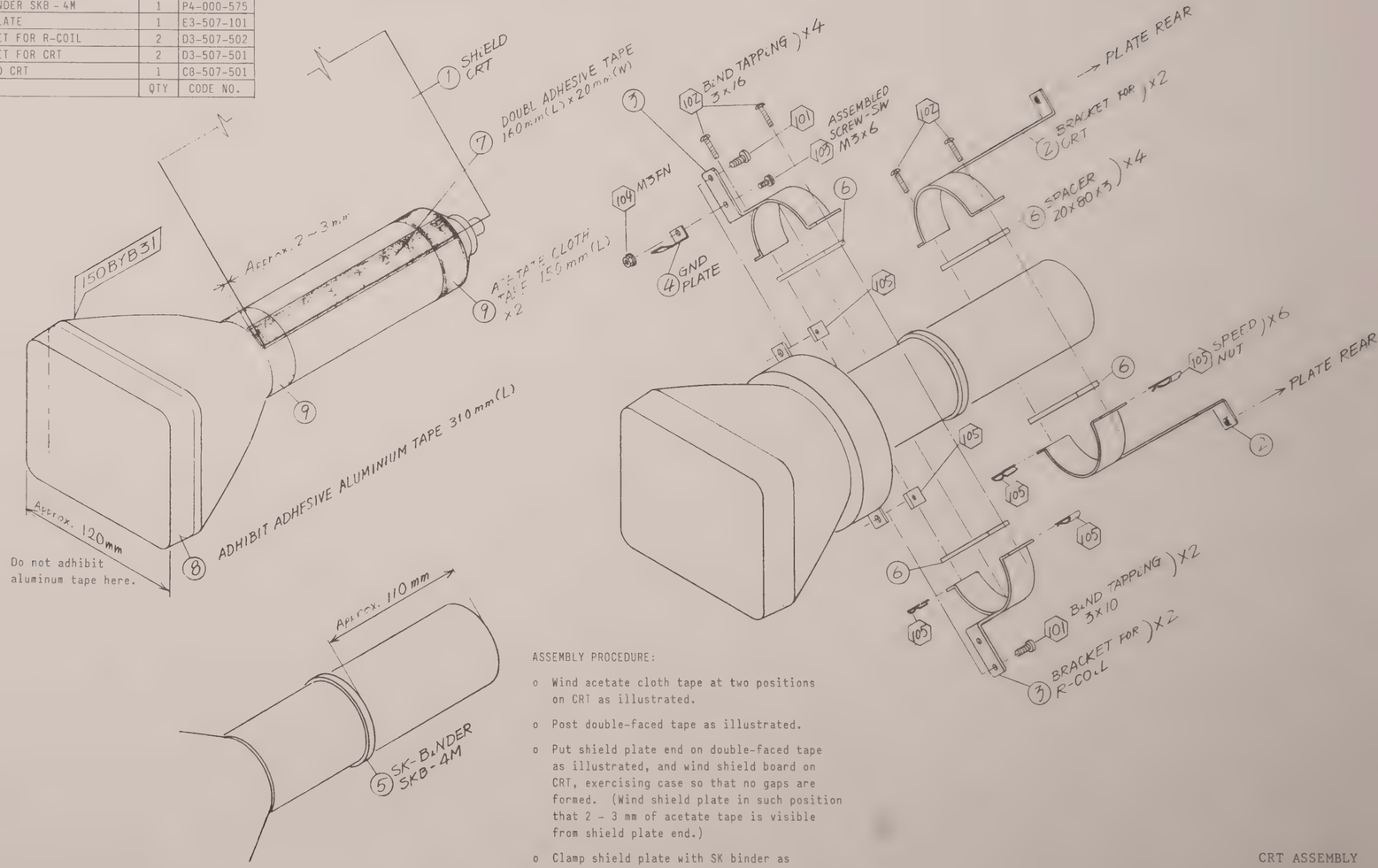
NO.	NAME	QTY	CODE NO.
8	PLATE VOLTAGE SELECTOR	1	C2-000-191
6	HOLDER CORD 3W	4	P3-000-101
4	STAY C-U	1	B5-507-103
3	STAY L-L	2	B5-507-102
2	STAY R-L	1	B5-507-101
NO.	NAME	QTY	CODE NO.

REAR PLATE ASSEMBLY
(COMMON DRAWING)

316100

NO.	NAME	QTY	CODE NO.
12			
11			
10			
9	ADHESIVE TAPE'ACETATE'571S	300mm	T4-000 131
8	ADHESIVE TAPE'ALUMI'833S	310mm	T4 000 121
7	ADHESIVE TAPE NO.721B W=20	161mm	T4-000-091
6	SPACER 20×80×3	4	R3-050-041
5	SK-BINDER SK8 - 4M	1	P4-000-575
4	GND PLATE	1	E3-507-101
3	BRACKET FOR R-COIL	2	D3-507-502
2	BRACKET FOR CRT	2	D3-507-501
1	SHIELD CRT	1	C8-507-501

NO.	NAME	QTY	CODE NO.
105	U-TYPE SPEED NUT	6	M8-000-391
104	FLANGE NUT M3FN	1	M4-010-021
103	SEMS-SW M3×6	1	M3-011-011
102	BIND TAPPING 3×16	4	M2-014-051
101	BIND TAPPING 3×10	2	M2-014-031



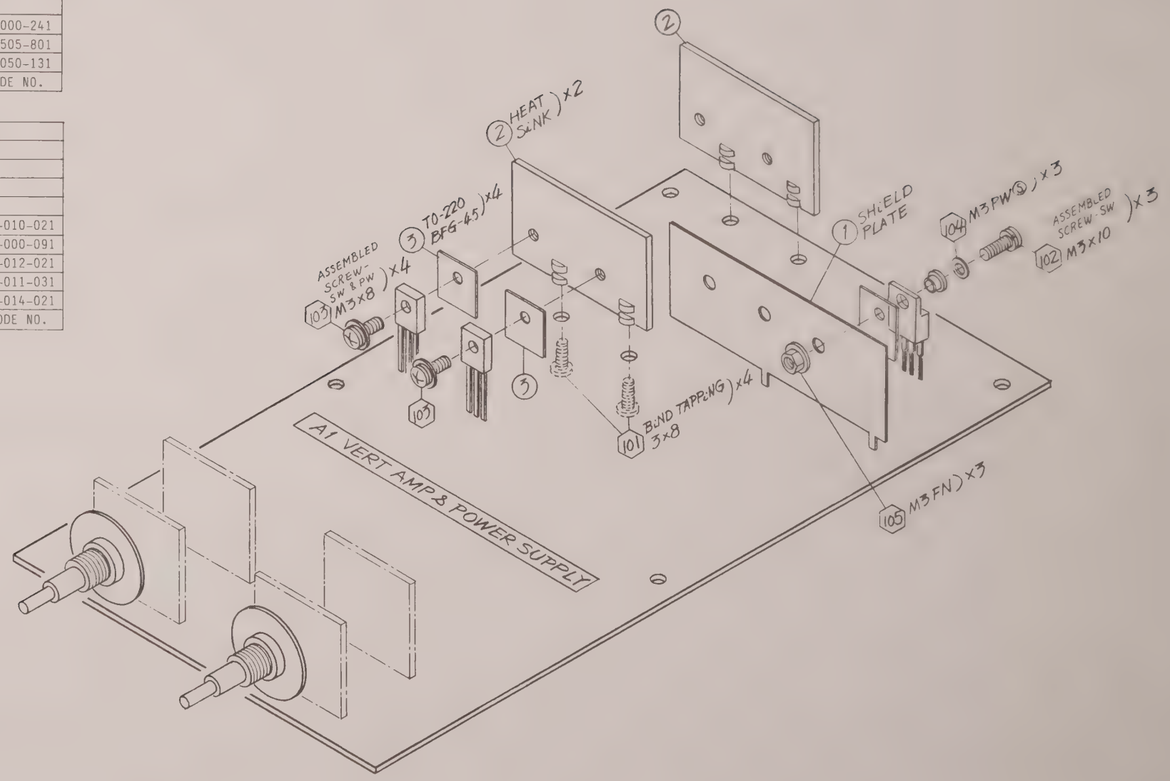
ASSEMBLY PROCEDURE:

- o Wind acetate cloth tape at two positions on CRT as illustrated.
- o Post double-faced tape as illustrated.
- o Put shield plate end on double-faced tape as illustrated, and wind shield board on CRT, exercising case so that no gaps are formed. (Wind shield plate in such position that 2 - 3 mm of acetate tape is visible from shield plate end.)
- o Clamp shield plate with SK binder as illustrated.

CRT ASSEMBLY

NO.	NAME	QTY	CODE NO.
5			
4			
3	TO-220 D-4 BFG-45	4	X1-000-241
2	HEAT SINK	2	H1-505-801
1	SHIELD PLATE 30×80×0.3	1	C9-050-131

NO.	NAME	QTY	CODE NO.
110			
109			
108			
107			
106			
105	FLANGE NUT M3FN	3	M4-010-021
104	WASHER M3PWⓈ	3	M5-000-091
103	ASSEMBLED SCREW-SWⓅPW M3×8	4	M3-012-021
102	ASSEMBLED SCREW-SW M3×10	3	M3-011-031
101	BIND TAPPING 3×8	4	M2-014-021



CIRCUIT BOARD ASSEMBLY
(VERTICAL)

NO.	NAME	QTY	CODE NO.
5			
4			
3			
2	IC-2425-ST HEAT SINK	1	H2-000-181
1	SHIELD BOX FOR DD-CON	1	C8-505-601

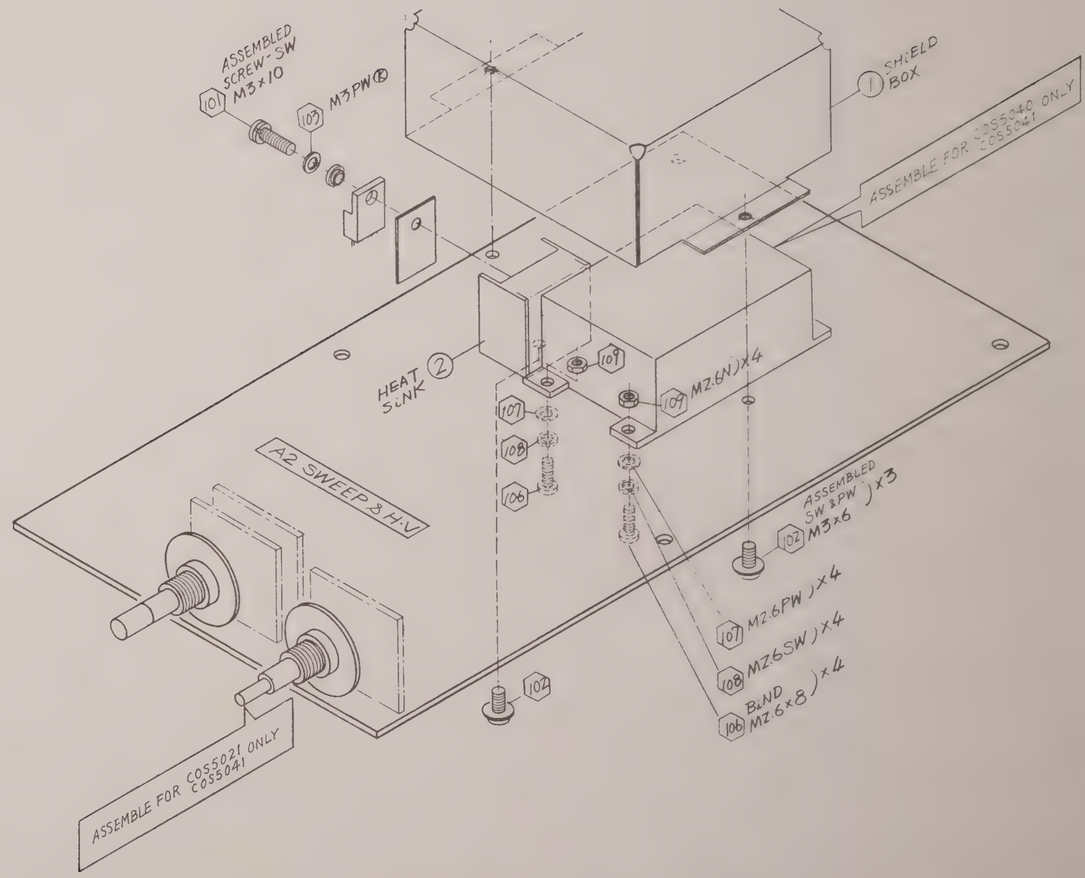
NO.	NAME	QTY	CODE NO.
105			
104			
103	WASHER M3PW(K)	1	M5-000-091
102	ASSEMBLED SCREW-SW&PW M3×6	3	M3-012-011
101	ASSEMBLED SCREW-SW M3×10	1	M3-011-031

FOR COS5040,5041 ONLY

NO.	NAME	QTY	CODE NO.
110			
109	NUT M2.6N	4	M4-000-021
108	SPRING WASHER M2.6SW	4	M5-001-021
107	WASHER M2.6PW	4	M5-000-021
106	BIND M2.6×8	4	M2-000-051

FOR COS5040,5041 ONLY

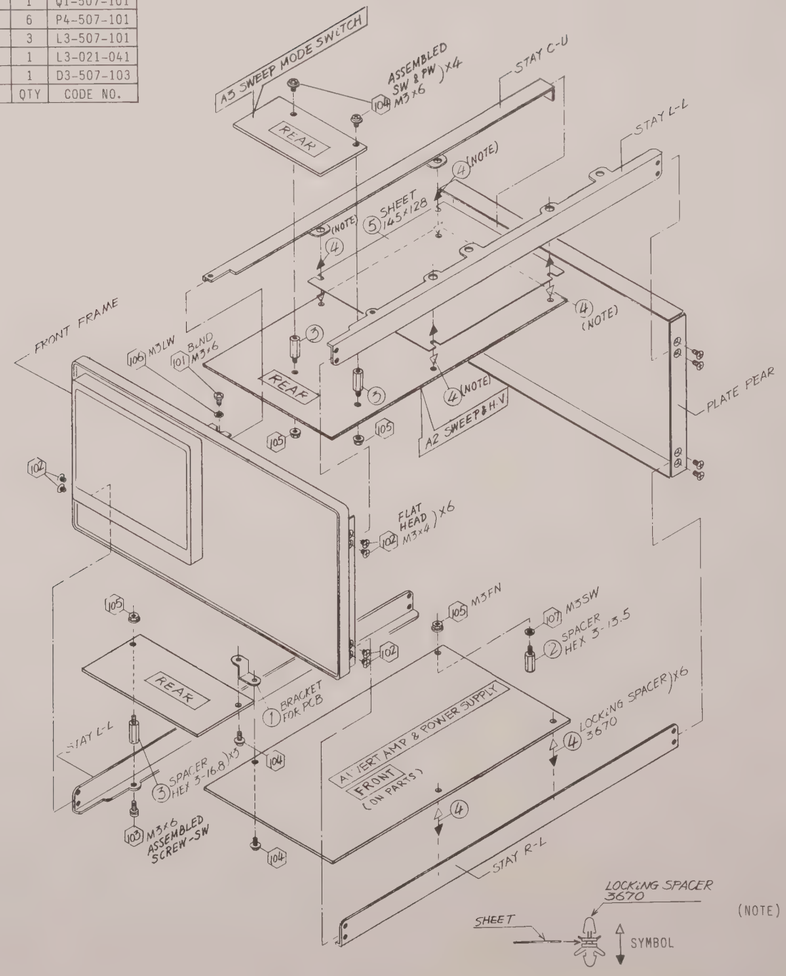
NO.	NAME	QTY	CODE NO.
9			
8			
7	BUSHING RUBBER BU-687EXS	1	P4-000-781
6	H.V UNIT CASE	1	P1-050-041

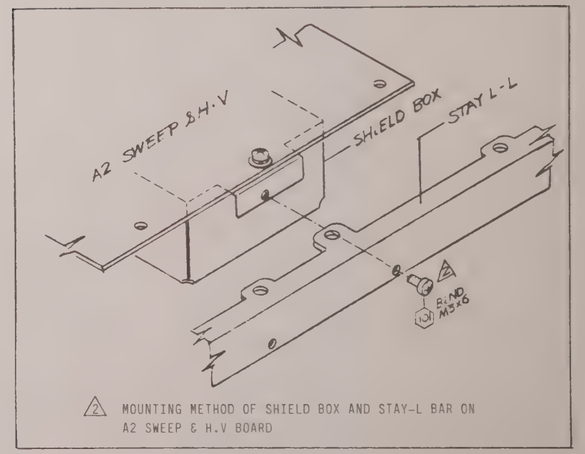


CIRCUIT BOARD ASSEMBLY
(TIME-BASE)

NO.	NAME	QTY	CODE NO.
10			
9			
8			
7			
6			
5	SHEET 145 × 128	1	Q1-507-101
4	NYLON LOCKING SPACER 3670	6	P4-507-101
3	SPACER HEX 3 - 16.8	3	L3-507-101
2	SPACER HEX 3 - 13.5	1	L3-021-041
1	BRACKET FOR PCB	1	D3-507-103

NO.	NAME	QTY	CODE NO.
110			
109			
108			
107	SPRING WASHER M3SW	1	M5-011-031
106	LOCK WASHER M3LW	1	M5-002-051
105	FLANGE NUT M3FN	4	M4-010-021
104	ASSEMBLED SCREW-SW&PW M3 × 6	4	M3-012-011
103	ASSEMBLED SCREW-SW M3 × 6	1	M3-011-011
102	FLAT HEAD SCREW M3 × 4	6	M2-001-071
101	BIND M3 × 6 B-NI	2	M2-000-391





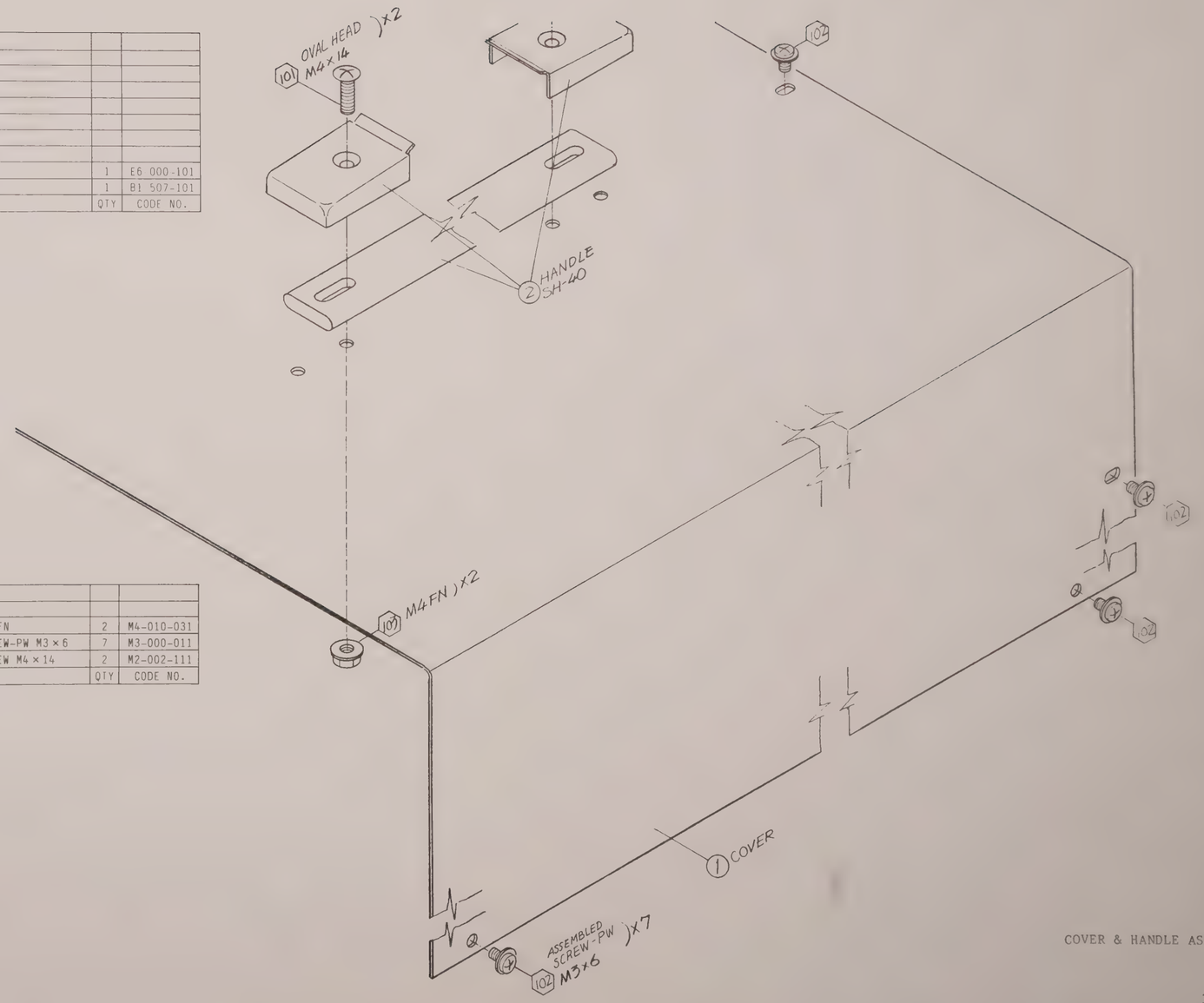
△2 MOUNTING METHOD OF SHIELD BOX AND STAY-L BAR ON A2 SWEEP & H.V BOARD

(NOTE) SHEET INSERTION METHOD:
Insert slit of sheet into gap at waist of locking spacer.

CIRCUIT BOARDS INSTALLATION

NO.	NAME	QTY	CODE NO.
10			
9			
8			
7			
6			
5			
4			
3			
2	HANDLE SH-40	1	E6 000-101
1	COVER	1	B1 507-101

NO.	NAME	QTY	CODE NO.
105			
104			
103	FLANGE NUT M4FN	2	M4-010-031
102	ASSEMBLED SCREW-PW M3×6	7	M3-000-011
101	OVAL HEAD SCREW M4×14	2	M2-002-111

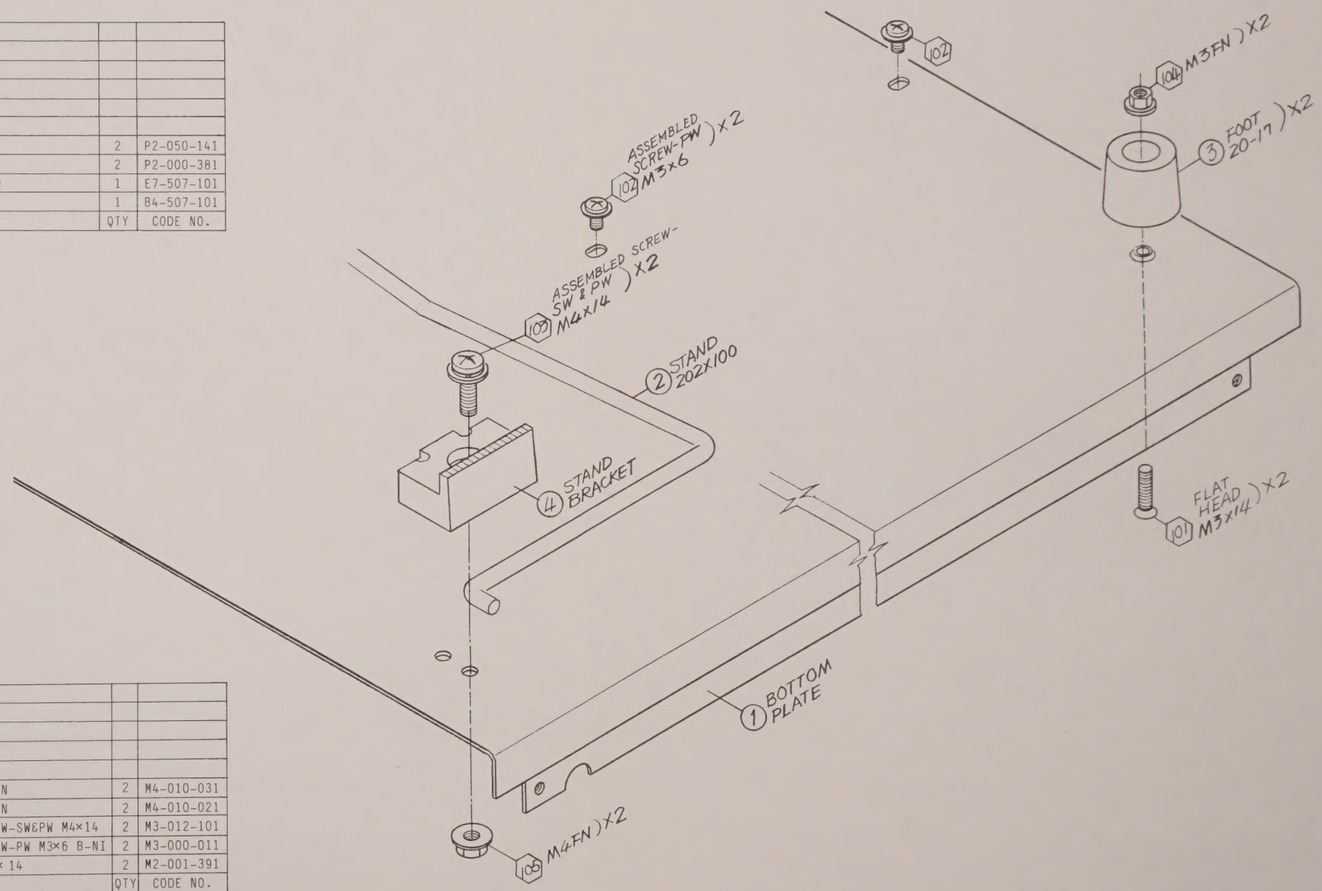


COVER & HANDLE ASSEMBLY

316109

NO.	NAME	QTY	CODE NO.
10			
9			
8			
7			
6			
5			
4	STAND BRACKET	2	P2-050-141
3	FOOT 20-17	2	P2-000-381
2	STAND 202 ×100	1	E7-507-101
1	BOTTOM PLATE	1	B4-507-101

NO.	NAME	QTY	CODE NO.
110			
109			
108			
107			
106			
105	FLANGE NUT M4FN	2	M4-010-031
104	FLANGE NUT M3FN	2	M4-010-021
103	ASSEMBLED SCREW-SW&PW M4×14	2	M3-012-101
102	ASSEMBLED SCREW-PW M3×6 B-NI	2	M3-000-011
101	FLAT HEAD M3×14	2	M2-001-391


(102) ASSEMBLED SCREW-PW M3×6) X2
(104) M3FN) X2
(3) FOOT 20-17) X2
(103) ASSEMBLED SCREW-SW & PW M4×14) X2
(2) STAND 202X100
(4) STAND BRACKET
(101) FLAT HEAD M3×14) X2
(1) BOTTOM PLATE
(105) M4FN) X2

BOTTOM PLATE ASSEMBLY

316110

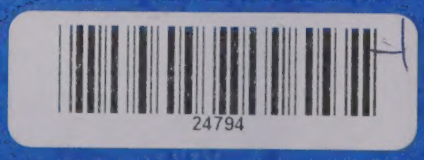
WARRANTY

All instruments manufactured by KIKUSUI ELECTRONICS CORP. are warranted against defects in materials and workmanship for a period of two years from the date of original shipment from the factory. However, this warranty excludes batteries, lead wires and probes, and CRT's are warranted only for a period of one year from the date of original shipment from the factory.

In the event of any defects in materials or workmanship, KIKUSUI ELECTRONICS CORP. will, at its sole option, repair or replace the defective instrument covered by this warranty without charge. To obtain warranty service, the defective instrument must be returned within thirty (30) days of the expiration of the applicable warranty period to KIKUSUI INTERNATIONAL CORP. properly packaged and with transportation and insurance prepaid. We will reship at our expense only to destinations in the United States.

Any defect in materials or workmanship determined by KIKUSUI INTERNATIONAL CORP. to be attributable to customer alteration, modification, negligence or misuse is not covered by this warranty.

EXCEPT AS SET FORTH ABOVE, KIKUSUI ELECTRONICS CORP. AND KIKUSUI INTERNATIONAL CORP. MAKE NO WARRANTIES EITHER EXPRESS OR IMPLIED, WITH RESPECT TO SUCH INSTRUMENTS, AND SHALL NOT BE LIABLE OR RESPONSIBLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES.


24794

Kikusui International Corp.

17819 S. Figueroa St., Gardena, Ca. 90248 (213) 515-6432 TWX910-346-7648 KIKUSUI GDNA

310